

AUTOMOTIVE INDUSTRIES

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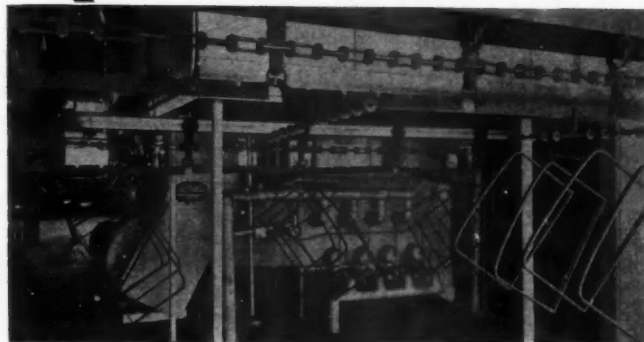
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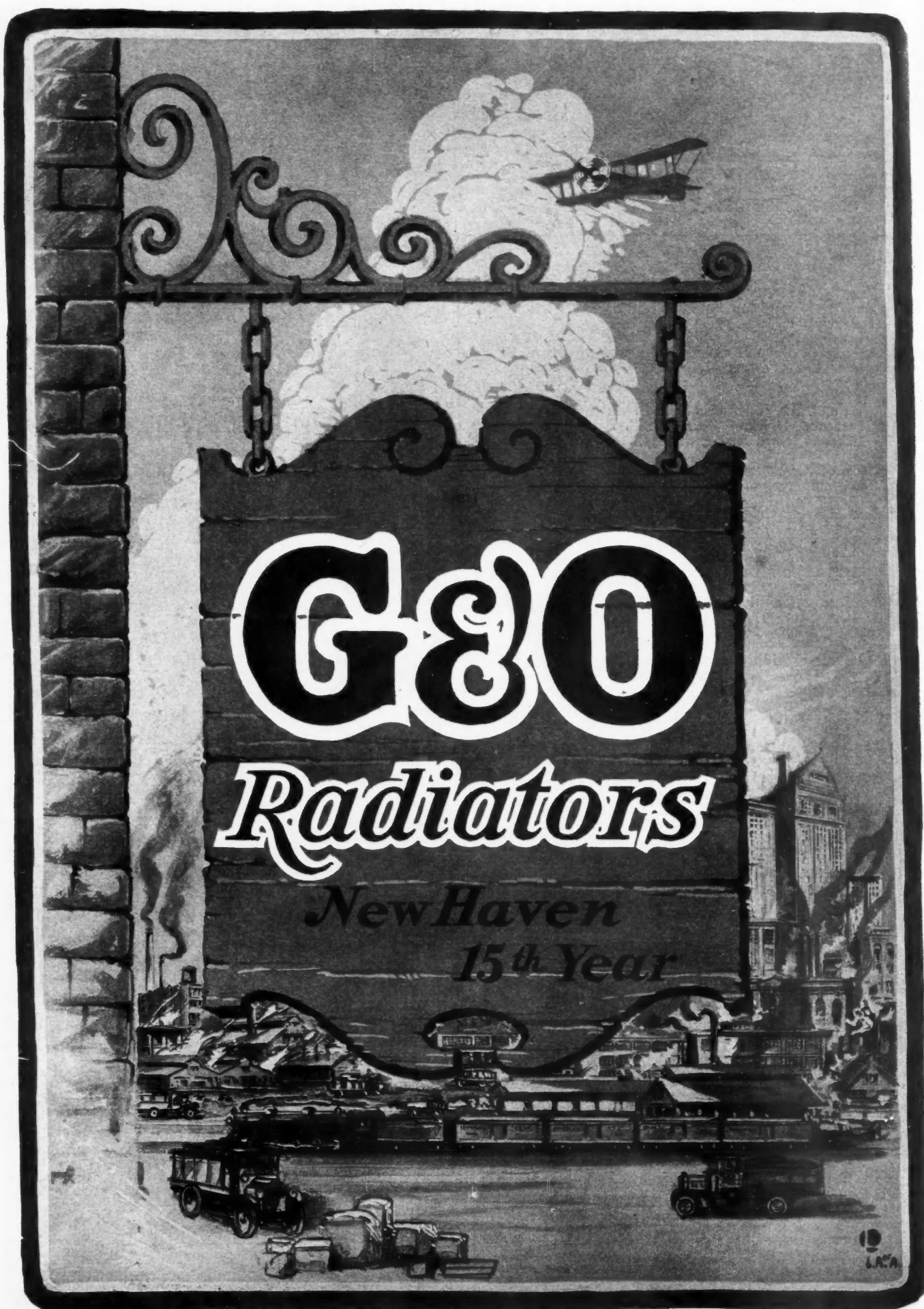
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A detailed black and white illustration for a GEO Radiators advertisement. The central focus is a large, dark wooden sign with ornate scrollwork at the top, hanging from a metal bracket. The sign features the word "GEO" in large, bold, white-outlined letters, followed by "Radiators" in a stylized script font. Below this, it reads "New Haven" and "15th Year". The background of the illustration depicts a bustling industrial scene with various buildings, including a tall skyscraper on the right, and several vintage automobiles from the early 1930s. A biplane is shown flying in the sky above the sign. The entire scene is framed by a decorative border on the left side, resembling a stone wall.

GEO
Radiators
New Haven
15th Year

L.A.C.A.

AUTOMOTIVE INDUSTRIES

VOLUME 62

Philadelphia, Saturday, February 15, 1930

NUMBER 7

Export Demand for Automobiles Reaches Highest Level

An upswing of large proportions during 1929 for trucks of every category ranged against a decrease, for the first time in years, of several classes of cars.

DEMAND for automotive products from all parts of the world showed further important increases through 1929, and the official export declarations of the United States and Canada, covering the whole range of the automotive industry, reveal that shipments last year rose to new high levels, with a wholesale value reaching the total of \$722,660,331. This was an increase of 9 per cent over the preceding year, or more than \$60,000,000. The remarkable record was attained despite considerably lower prices on many products, such as passenger cars, trucks, tires, batteries, etc.

The whole year was an event-

By **GEORGE E. QUISENBERRY**

*Editor, American Automobile
and El Automovil Americano*



ful one for the export section of the industry and its customers in all continents. Changes in buying

habits were numerous and affected many lines, some of which made surprising increases in the face of decreases in other parts of the list. An upswing of large proportions in the demand for trucks of every category ranged against a decrease, for the first time in years, of several classifications of cars, although, with the production of passenger cars in the branch assembly plants throughout the world, an expanded number of cars were sold in all countries.

Shipments of complete trucks from the factories of the two producing nations, enlarged by

American Exports by Continents

	Automobiles	Cars	Trucks	Buses	Motorcycles
Africa	319,365	251,251	61,532	2,550	60,038
America (excluding U. S.)	2,047,477	1,666,173	354,339	23,444	20,398
Asia	509,256	373,740	126,508	8,008	74,485
Europe	4,849,793	3,285,577	1,195,995	128,876	2,157,718
Oceania	788,773	639,588	148,022	1,265	138,024
United States	26,564,659	23,225,727	3,248,377	90,551	115,226
Grand total 1930	34,879,323	29,442,056*	5,134,773*	254,692	2,585,889
" " 1929	31,851,790	...	...	...	...
Increase 1930 (World excluding U. S.)	957,454	...	...	...	...
Increase 1929 (World excluding U. S.)	972,557	...	...	...	...

* Not complete for all sections.

the total of 44 per cent, reflected practically throughout all types of such units, but particularly in the smaller sizes that are now being used so widely for commercial, delivery and bus purposes. Assemblies of both cars and trucks, in the plants outside of the United States, increased by more than 50 per cent, and the small decrease of car shipments from the United States was accompanied by a considerable enlargement of car exports from Canada, these two factors signaling the fact that Ford came back into major export activity through all of the year, for the first time since the change-over to the present line of cars and trucks.

Practically all products entering into the export business were bought at lower prices in 1929 than in 1928. The unit value of the passenger cars shipped from the United States decreased from \$715 in 1928 to \$691 in 1929 and those from Canada were decreased from \$451 to \$438. Trucks shipped from the United States decreased from \$660 to \$588, as an average, while Canadian trucks increased from \$386 average value in 1928 to \$403 in 1929. In stating the decline in truck values, the wrong inference is given that sales of the higher-capacity units, in excess of 1 or 1½ tons capacity, were lower. While there was a considerable increase in the shipments of all categories, the increase was more rapid in the smaller-sized vehicles.

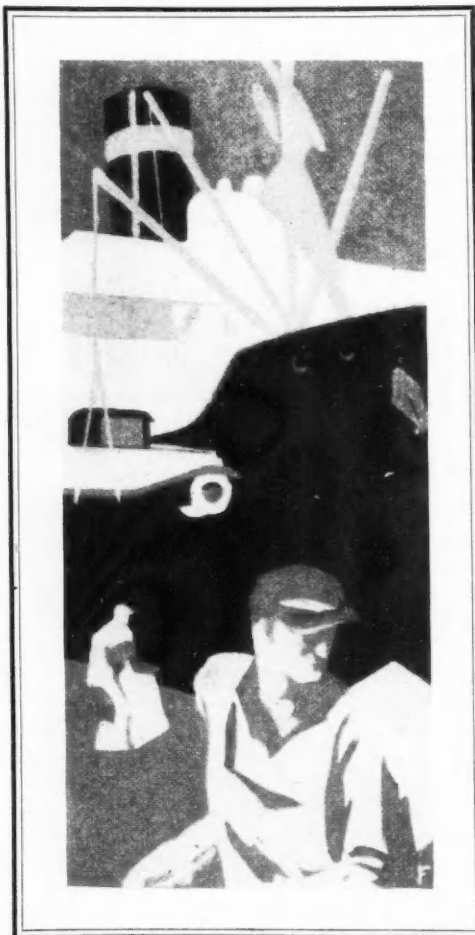
Explanation must also be made of the surprising record of the assembly branches overseas of the larger car and truck companies. The 1929 record of these operations, which, with the exception of a few plants in Europe of other manufacturers, are those of the two largest producers, was by far the highest totals ever reached. The complete record of the overseas assemblies is given as follows:

1929—354,850 units	1926—145,774 units
1928—229,248 units	1925—152,262 units
1927—203,514 units	1924—116,148 units

8,314,664 Cars Outside U. S.

WITH the United States excluded, the world use of automobiles has increased by almost 1,000,000 cars, and this year reached 8,314,664 units and 2,440,663 motorcycles. The increase during 1929 was practically the same as in the preceding period, despite a much larger total of sales, but against mounting replacement demand, as follows:

CALENDAR YEAR	GAIN
1929 to 1930—957,454, or 13 per cent	
1928 to 1929—972,557, or 15.2 per cent	
1927 to 1928—917,325, or 16.8 per cent	
1926 to 1927—858,997, or 18.3 per cent	
1925 to 1926—974,059, or 26.8 per cent	
1924 to 1925—625,463, or 21 per cent	



Thus there is graphically depicted the steady expansion of these plants, now numbering about 40 in all countries outside of the United States and Europe. The past year was the first in the history of the industry when the plants of both Ford and General Motors were operating at high levels. The Ford assembly branches had not been fully occupied until 1929 since 1926-27, when the old model line was still being produced. But then the assembly program of General Motors had only been partially developed. Production of the plants of that company expanded considerably and reached high volume of production during 1928, when, after introduction of the Model A, the Ford branches were only in partial assembly. But last year both companies were under large scale operation in their various branches, with output reaching more than 350,000 units, the first year in which it has passed the quarter-million total.

Of these overseas assemblies, many of them are also reported as exports of complete cars from the United States or Canada and, as such, are counted

in the declared exports. A certain part of these assembled vehicles are shipped abroad as parts, the units being completely assembled abroad, and such automobiles are not shown in the official declarations as automobiles. Consequently, provision must be made for these locally assembled units which are estimated, from the best available information, as follows:

1929—187,543 units	1926—157,500 units
1928—72,000 units	1925—170,000 units
1927—80,000 units	1924—155,000 units

Census of Operation

THE census totals for automobiles in operation follows:

Jan. 1.	World Including United States	World Excluding United States
1930	34,879,323	8,314,664
1929	31,851,790	7,357,210
1928	29,638,535	6,384,653
1927	27,527,238	5,467,328
1926	24,452,267	4,608,331
1925	21,374,506	3,634,272

Thus, in five years, the use of automobiles in all parts of the world has increased by approximately two-thirds. But, with the United States excluded, and considering only the other parts of the world, the increase has been about 130 per cent.

While the tables accompanying this article are, in some instances, incomplete, they give an accurate picture of the upward trend in foreign fields open to American manufacturers

1923—120,000 units
1922— 80,000 units
1921— 37,500 units
1920— 28,000 units

Many countries last year set new records in the buying of both cars and trucks, particularly the latter class of vehicles making the most important increases. But in the field of equipment and parts were the most spectacular increases, as the trade will understand results from the steadily mounting registration totals. Service is more necessary and, with enlarged ownership of cars, trucks and buses, more adequate garage equipment may be installed by the service station operators and garage proprietors of all countries. Replacement parts must grow for the same reason and, doing so, distribution becomes more widespread, wholesale and importing companies are enabled to enlarge their selling operations, and the entire demand grows apace. The partial record of the year's results in these lines are shown in accompanying tables, increasing to volume totals in practically every section of the world.

Progress in Motorization

The 1930 motor vehicle census shows little relative change in the positions of the various territories. It does show general progress in the motorization of world transport services and uses, and many sections in 1929 set new records of automotive development. This development has been marked particularly in the truck field, where many thousands of new vehicles have been put into service during the past 12 months. The truck for commerce, agriculture, freight, express and delivery services, and the bus for passenger and mail transport, have both made vast strides during 1929. The bus, whatever type it may be, is becoming rapidly the vehicle for mass transportation of passengers, and, in studying the detailed reports from the various countries, it was realized quickly the parts these larger vehicles are playing in the automobile trade of the world.

Trucks have a much closer ratio of operation to pas-

World Motor Census

THE world use of automobiles has increased almost to 35,000,000. The Annual World Motor Census of the American Automobile (Overseas Edition) and its companion magazine, El Automovil Americano, complete for more than 125 territories and major political subdivisions of Africa, America, Asia, Europe, Oceania and the several island groups of the world shows 34,879,323 automobiles and 2,565,889 motorcycles in service as of Jan. 1, 1930.

The increase, far larger than for any year since 1926, was a gain of 3,027,533 units over the 31,851,790 motor vehicles which were in operation on Jan. 1, 1929.

The comparison of increases shows the following gains of automobiles:

CALENDAR YEAR	GAIN
1929 to 1930—3,027,533, or 9.5 per cent	
1928 to 1929—2,213,255, or 7.5 per cent	
1927 to 1928—2,111,927, or 7.7 per cent	
1926 to 1927—3,074,971, or 12.6 per cent	
1925 to 1926—3,077,761, or 12.7 per cent	
1924 to 1925—3,133,031, or 17.2 per cent	

senger cars in most countries than in the United States. In the United States the ratio is about one truck to each seven or eight passenger cars. In other parts of the world the ratio is closer to one truck for each three or four cars, and in many sections trucks are even more numerous than cars.

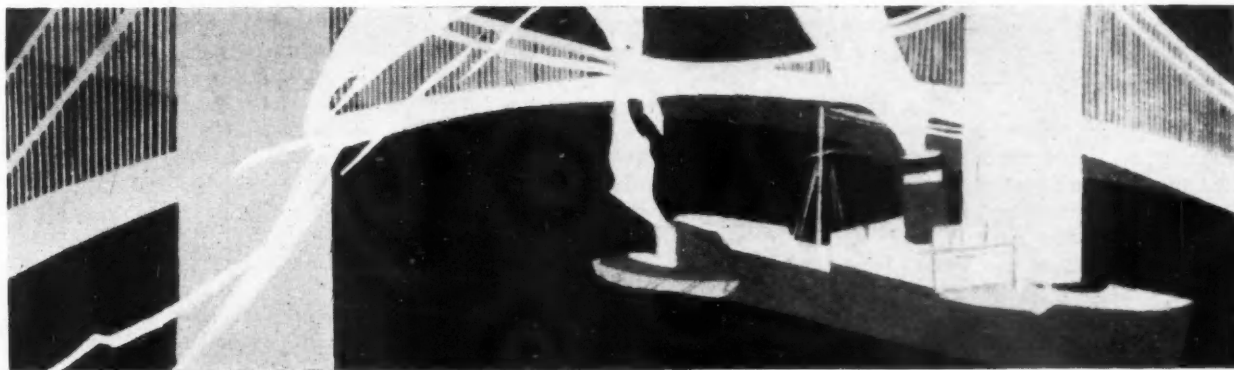
Although the census information is not complete, it indicates the replacement in 1929 of between 500,000 and 550,000 units in all territories other than the United States.

Something in excess of 1,500,000 automobiles

were available for sale outside of the United States last year, and, with the indicated increase of 950,000 vehicles in the 12 months, there remains an approximate 500,000, after allowing for unsold stocks and shipments in transit, that must have gone into replacements. The previous census indicated about 350,000 units replaced in 1928, and the indicated total for 1927 was 250,000.

While these compilations are not entirely accurate, they are, nevertheless, extremely important in showing the growth of the export phase of the industry which is now taking a higher proportion of the total production of motor vehicles every year. Year by year, as the trade continues, the demand for replacement vehicles will mount, just as it has in the United States, effecting all sections of the trade.

Several indications tend to show that the American manufacturers are increasingly interested in European assembly plant operations and any expansion of these interests will have more than a casually salutary effect on those European statesmen who have begun to agitate stricter tariff barrier against American-made products. The further ameliorating effect on increasingly high foreign tariffs is the practice to practically prohibit entry of bodies, yet allowing chassis to be shipped in at a comparatively low figure. This may help to bring up the total export for 1930 to about the 1929 figure, or may assist in bringing about a new record for exports.





Joseph Winlock, research metallurgist, Edw. G. Budd Manufacturing Co.

Success of *Deep Drawing* *Depends Upon Micro*

Control of grain size and arrangement at the rolling mill and the press shop will eliminate troublesome production problems.

CHARACTERIZED by prominent metallurgists as being an outstanding contribution to the practical art as well as to scientific progress in the manufacture and use of sheet steel, "Some Notes on Sheet Steel and Strip Steel for Automobile Bodies," a paper by Joseph Winlock and George L. Kelley, both of the Edw. G. Budd Mfg. Co., was read by Mr. Winlock before the American So-

ciety for Steel Treating at their semi-annual meeting in New York last week.

The authors, speaking with the authority gained by years of practical research in deep drawing problems have selected for study a number of the most troublesome defects which occur in sheet steel fabrication and present an explanation for these phenomena, postulated on studies of actual production problems in their plant. With the happy combination of technical skill and a fund of practical experience and information, they analyze certain chronic production troubles, show how and why they occur and suggest practical means for minimizing or eliminating them in such a way as to be readily usable by the production men in any press shop. It becomes evident from a reading of this paper that the microstructure of the sheet is directly linked with the problems affecting its final fabrication. Accordingly, the paper undertakes a condensed but complete discussion of the granular structure of the sheet, the effects of grain size upon deep drawing properties and how grain size may be controlled at the rolling mill as well as in the press shop.

The designer and die maker are probably well acquainted with the phenomenon of "springback" where the stamping after being removed from the press assumes a slightly altered shape. The reasons for this may not have been definitely understood but the designer invariably laid out the dies so as to counteract

this effect. In this paper the authors explain the reasons for the springback, based on sound scientific fact. Another deep drawing problem of unusual significance is that of stretcher strains which are responsible for many rejections and when occurring in the milder form of "roughening" increase the cost of the finished stamping because of added grinding and polishing operations. Brittleness and torn edges are also explained and in each case the explanation is complete enough to show the designer or production man where to look for the trouble and how to correct it.

"The steel most widely used for deep drawing purposes," the authors say in opening the paper, "is a basic open-hearth steel of the following approximate analysis: carbon, under 0.14 per cent; manganese, under 0.60 per cent; phosphorus, under 0.045 per cent; sulphur, under 0.045 per cent.

"The maximum carbon content of 0.14 per cent has been specified because experience has shown that an increase in the carbon above this figure leads to a too marked decrease in the ductility of the steel. An exception to this is steel used for light draws, or for a series of light draws with intermediate annealing processes employed to obtain the desired formation. A further exception is steel of the heavier gages (eleven and lower) used in forming certain stampings such as automobile brake drums, axle housings, chassis frames, etc."

"For the deeper draws of the lighter gaged sheets (eighteen gage and higher) the present tendency is to lower the maximum carbon to 0.10 per cent, and often to lower the maximum manganese content to 0.30 per cent. No definite conclusions have as yet been reached, however, as to the most desirable analysis.

"Steel of aforementioned analysis is particularly susceptible to conditions which tend to produce a lack of uniformity in the finished sheet or strip and the physical properties of finished sheets may often show a wide variation not only between individual sheets of the same lot, but also in the same sheet.

"Impurities are more apt to segregate in the ingot than in steels of a higher carbon content, and it is difficult to obtain satisfactory deoxidation of the molten steel. Blow holes are more apt to form in steel of this carbon content on account of its relatively low dissolving power for gases at low temperatures, and the use of too much aluminum to overcome this condition results in a 'dirty' steel. Subcutaneous blow holes and those formed near the center of the ingot, being less liable to oxidize than those on the surface, will, however, usually weld together satisfactorily in the subsequent rolling processes. Unwelded blow holes together with 'pipe' are the chief causes of 'laminations' in sheet and strip steel.

Operations on Strip and Sheet Steel structure

"Steel of this analysis, particularly when rolled to light gages, is especially susceptible to large grain size changes occurring in the various annealing operations."

In the next portion of the paper which deals with cold working, the authors observe that, "Sheet steel is cold rolled primarily to obtain good surface qualities, uniform gage, and flatness, i.e., freedom from buckles and waves. The reductions in thickness produced by cold rolling are seldom more than 3 per cent. Strip steel is cold rolled for the same reasons, with the additional purpose of rolling to the lighter gages, particularly in the wider sizes. In the case of strip steel, the reductions effected by cold rolling are usually 20 per cent or more. If the sheet or strip is to be used for stampings in which the draw is only of moderate depth, a final pass on the cold rolls may be employed. This improves the surface and increases the 'stiffness.'

"To refer to one steel as being 'stiffer' than another of the same thickness is incorrect because the rigidity (resistance to deformation) is the same in all steels. This is shown by the fact that the modulus of elasticity is practically a constant value: 30,000,000 lbs. per sq. in. A steel, therefore, which has been severely cold rolled, when compared with one which has not been cold rolled, will not resist a greater load before elastic deformation takes place, but the severely cold rolled steel, having a higher elastic limit, can be deformed a greater amount and withstand a greater load before permanent deformation takes place."

"Mechanical deformation of iron and steel at low temperatures greatly affects the physical properties of these metals, the elastic limit, tensile strength, and hardness being increased, while the ductility, as represented both by the elongation and reduction of area is decreased. The density of iron and steel is slightly decreased by cold working.

"The smaller the grain size prior to cold rolling, the greater is the work-hardening effect produced by a given amount of cold rolling. This appears, at first, to be inconsistent with the general observation that 'A pass on the cold rolls will not lower the ductility of a small grained sheet so much as it will a coarse grained sheet.' These statements are not contradictory, however, because the actual reduction obtained per pass on the cold rolls is greater in a large grained material than that obtained in a smaller grained material. Thus, 'box-annealed' sheet steel, which generally has larger grains than strip steel or 'normalized' sheet steel, is, when compared with these after the same number of passes on the cold rolls, the least ductile."

"The percentage elongation in tensile specimens taken in a direction parallel to the direction of rolling is generally higher and the tensile strength and yield point generally lower than in specimens taken in a direction transverse to the direction of rolling. Cold rolling tends to accentuate this difference in that the rate of change to a lower ductility, for a given amount of reduction, is greater in the transverse direction than in the longitudinal direction. As a result of this, blanks for stampings are laid out, wherever possible, so that the maximum amount of the draw will take place in a direction parallel to the direction of rolling. And, in particular, bending of the metal flat on itself ('dutch bending') in a line parallel to the direction of rolling is avoided as much as possible."

"A measurement of the increase in hardness by cold rolling and the decrease in hardness after subsequent annealing has not proved to be a re-



Dr. George L. Kelley, chief metallurgist, Edw. G. Budd Manufacturing Co.

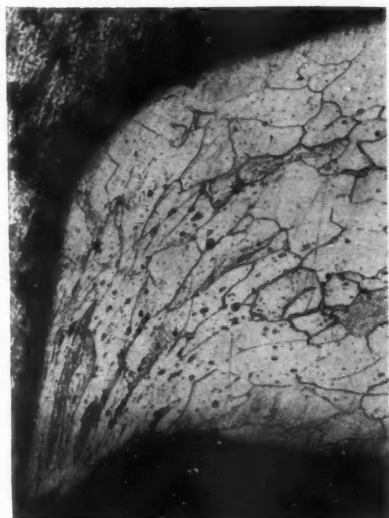
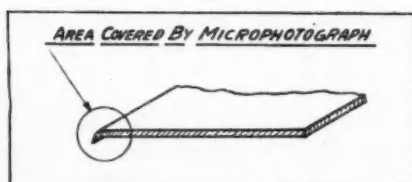


Fig. 1—Microphotograph of a sheared edge of sheet steel (100X). Smaller view shows (below) the area covered by the microphotograph



liable indication of the deep drawing qualities of steel because, as Jeffries and Archer point out: 'A metal may be obtained with the same hardness by moderately working a coarse grained piece or by annealing a severely worked piece at a temperature that will produce small unstrained grains. Although the hardnesses are the same, the other properties may not be, and usually are not, the same.'

"In deep drawing, the elongation or stretching of a blanked or sheared edge is undesirable. This is because the blanking or shearing operation as a result of the attendant cold work, causes a decrease in the ductility at the edge of the metal. Incipient tears may also be produced. The presence of these small tears in the edge of the steel causes, in drawing, concentrations of the imposed stress just as a small cut at the edge facilitates the tearing of a piece of coarse cloth. Fracture of the metal occurs, then, by a tearing action. Fig. 1 shows the microstructure of a sheared edge of sheet steel with elongated grains caused by the cold work, while Fig. 2 shows the tears which often occur as a result of the conditions just mentioned. The use of a blanking die which is not sharp or properly aligned obviously accentuates these conditions. Fractures due to these causes may often be prevented either by filing or grinding away the damaged edge, or by annealing it."

"If, after the yield point has been passed, the stress producing the deformation is removed, it will be found that instead of the stress having produced total permanent deformation a slight amount of elasticity remains in the steel. This is shown in the stress strain diagrams of two different steels, Fig. 3. It is evident that there are other forces existent in deep drawing operations in addition to those which manifested in the stress strain diagrams obtained in tensile testing. But owing to the

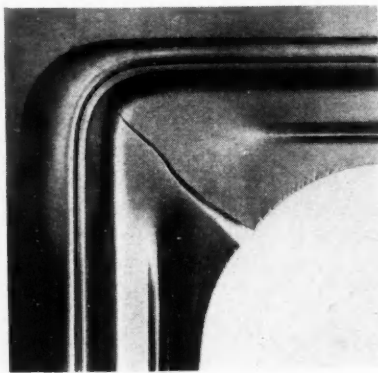


Fig. 2 (Left) — Tears resulting from stretching a blanked edge

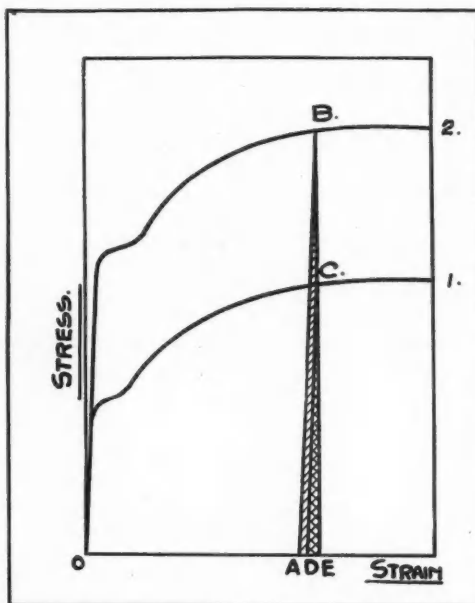


Fig. 3 (Above) — Stress-strain diagram, illustrating phenomenon of "springback" in stamping

along the perpendicular lines CE and BCE . The length of the lines DE and ADE is, then, a measure of the residual elasticity in the two steels respectively.

"In the deep drawing process, this phenomenon is known as 'spring back.' Upon further examination of these curves it will be seen that the greater the stress necessary to produce a given deformation, the larger will be the amount of spring back. The higher the tensile properties of the steel, therefore, the greater will be the amount of spring back for a given deformation.



Fig. 4 (Above) — An automobile body stamping, showing the appearance of stretcher strains

And, further, as the amount of the deformation increases, the amount of spring back will be larger, the greater the rate of increase on the stress. Allowance must be made for this property of steel by so designing the dies for deep drawing operations that the metal will be deformed an amount greater than that desired in the finished stamping.

"The work necessary to deform steel may be expressed by the area under the stress strain diagram. This constitutes a measure of the 'toughness' of the steel. For a given deformation, then, a greater amount of work will be required to deform a steel having a high yield point and tensile strength than is required to deform a steel in which these properties are lower. The average yield point of box-annealed sheet steel is approximately 25,000 lb. per sq. in. and the average tensile

strength approximately 40,000 lb. per sq. in. The average yield point of strip steel and 'normalized' sheet steel is approximately 50,000 lb. per sq. in. Modifications in the design of the dies and changes in the adjustment of the presses are often necessary to compensate for such differences in properties as these."

The authors now fully discuss the phenomenon of stretcher strains and show how these may be controlled. "For," Mr. Winlock stated, "when sheet and strip steels have been subjected to permanent deformation slightly beyond the elastic limit by stresses which are primarily tensile stresses, it sometimes happens that instead of the surfaces of the steel becoming uniformly roughened, irregular lines of depressions occur which destroy the evenness of the surfaces of the metal. If the stresses producing the permanent deformation are primarily compressive stresses, irregular lines of elevations occur. These markings known as "stretcher strains" or, more appropriately, as "worms" are shown in Fig. 4. In some cases, these depressions are so extensive and so

fact that stress strain diagrams which include all the forces with a given force predominating, are not at present available, it is believed that the stress strain diagrams obtained in tensile testing lend themselves best to the discussion of the phenomena noted in deep drawing operations. As the stress is removed, the relation of stress to strain returns along the line CD for curve No. 1 and the line BA for curve No. 2, instead of

deep that it is necessary to grind and polish the entire surface of the stamping. Even this is not always accomplished satisfactorily, because the heat produced results in a distortion of the stamping."

"Our conception of the *modus operandi* of stretcher strain formation and our observations regarding the prevention of this occurrence follows. When a stress is applied to steel, the resulting deformation is either mainly elastic or mainly plastic according to the amount of the imposed stress. Elastic deformation is produced when the intensity of stress is of such a degree that no permanent deformation will remain when the stress is removed. In elastic deformation, the stress is proportional to the strain. If, however, the stress is of such a magnitude as to produce permanent deformation, the deformation is mainly of a plastic nature. The structure of the steel is changed: the crystalline grains being permanently elongated in the direction of the applied force.

"The permanent deformation of steel takes place by a process of slip or gliding action within the crystalline grains. This slipping or gliding action does not take place in all of the grains simultaneously, but according to the resistance to slip of the different grains, or groups of grains. Resistance to slip is influenced principally by (1) the size of the grains, (2) the orientation of the grains in relation to each other, (3) the relation of this orientation to the direction of the stress producing the deformation and (4) the slight concentrations of stress which may exist in the metal while it is being deformed.

"Upon examination, it will be seen that these various influences are accentuated to a marked degree in steel rolled to light gages because of the relatively small number of grains in the cross section, and because small changes in grain size noticeably affect the physical properties.

"As this alternate slipping and work-hardening continues, and the extent and number of the depressions in the surface of the metal increase, the effect of contrast continually diminishes until the condition is reached when the entire surface has been affected and the variations have become relatively minute. In effect, this is a return to the original even surface. When all of the grains have slipped in this manner, the stress strain curve commences to rise again as a relatively smooth curve.

"Stretcher strains are due, then, we believe, to the fluctuations occurring at the yield point caused by the comparatively sudden transitions in different grains, or groups of grains, from the elastic to the semi-plastic state. Their appearance is a normal characteristic of steel. It shall be noted that in some cases the fluctuations are so small that only a roughening of the surface of the metal takes place. Roughening of the surface and stretcher strains are manifestations of the same phenomenon. It is a question of *degree and not kind*. A measure of the decreases and increases in load occurring after the yield point of the metal has been reached would, therefore, give an indication of the intensity of

the resulting stretcher strains. The elongation necessary to produce stretcher strains is between 1.5 per cent and 10.0 per cent. They occur, then, in stampings or those parts of stampings where the amount of the draw is correspondingly slight."

"Experiments have shown," continue the authors, "that the smaller the grain size of the metal, the greater will be the tendency for stretcher strains to appear. Where specimens with a small grain size showed deep depressions when the yield point was reached, specimens having only a few grains in their cross sections, in undergoing permanent deformation, showed only a roughening of the surface. It is interesting to note that the stress strain curve of a steel having very large grains resembles very closely those of the non-ferrous metals which, as is well known, are characterized by a lack of definite yield point. Experiments were also made on the non-ferrous metals, aluminum and copper, in the attempt to produce stretcher strains. As was expected, however, only a roughening of the surface took place as in the case of the coarse grained steel.

"Let us now suppose that enough permanent deformation or cold work is imposed on the steel, before the deep drawing operation, so that all or most of the grains have partially slipped. Any subsequent deformation will be for the most part of a plastic nature. It will be noticed that the stress strain curve departs from the straight line denoting elastic deformation, and the proportional limit has been reduced practically to zero; also the curve is smooth from origin to fracture. Stretcher strains will not occur when steel in this condition is permanently deformed."

"Sheet and strip steel may be cold worked to produce this condition either by cold rolling, roller leveling, or stretcher leveling. If the steel shows a tendency to kink or 'break' in the roller leveling operation, this may be prevented sometimes by gradually increasing the amount of bending. Kinks are simply localized stretcher strains and should not be allowed to occur because the drawing operation may not always be of such an amount as to result in their removal. The amount of cold work necessary to prevent stretcher strains from occurring is relatively slight and in the case of roller leveling, even when using machines especially designed to produce drastic bending, a great number of passes have been found necessary to lower appreciably the ductility of the steel.

"It is well known that steel in the 'overstrained' state is in an unstable condition, and if the metal is permitted to rest or 'age' or is heated slightly, it will recover its elasticity. Muir reports that elastic recovery at 212 deg. F. is as complete after a few minutes as in two weeks at room temperature, and is impeded or entirely prevented at lower temperatures, i.e., around 32 deg. F. On recovery, the steel will have a new elastic limit higher than that of the original material and will be slightly harder. Our experience has shown that for consistent results, the steel should be roller leveled within the twenty-four hour period preceding the draw-

(Turn to page 237, please)

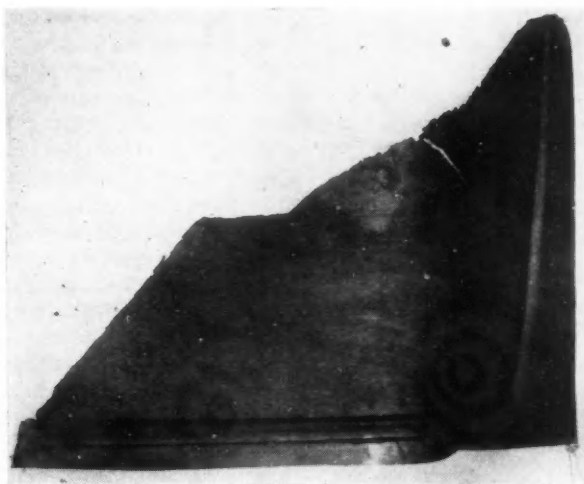


Fig. 5—The profile of a fracture peculiar to Stead's brittleness in a portion of a stamping

Uses of Rubber in Automobile

R. K. Lee

The co-author of this article, R. K. Lee, research engineer, Chrysler Corp., has been associated with the engineering department of that company for the past three and a half years. He has been in the automotive industry for the past 14 years.

In connection with his work at the Chrysler Corp., Mr. Lee has been responsible for the development of numerous applications of rubber, including the adhesion type of rubber engine mounting which is now extensively used on American passenger cars.

In this article Mr. Lee outlines the various uses of rubber in the present-day automobile, pointing out the effect of various constituents in the many different types of compounds on their final characteristics. The engineer or production man who has had troubles with different "rubber" parts will, no doubt, be able to find much in this article that will interest him.

THE uses of rubber in automobile production and the variety of materials which come under this general classification have increased to such an extent during the past few years that the Chrysler Corp. has found it necessary to employ engineers with special training in this field. These engineers, cooperating closely with the research laboratories of the rubber companies, in turn have been responsible for further extension of the uses of rubber in the automobile. Three years ago the average car had in its make-up from 10 to 15 lb. of rubber, exclusive of tires; today a Chrysler car, aside from tires and tubes, contains from 40 to 60 lb. of material coming under the general heading of rubber, in about 150 pieces of 50 different designs and compositions.

Aside from tires and tubes, the rubber articles in automobiles can be divided into the following 12 groups:

1. Flat-molded stock, used for running board and floor mats, etc.
2. Extruded rubber, both plain and cloth-covered, as, for example, in window laces, tubing, etc.
3. Wrapped hose for hydraulic brakes, radiator connections, etc.
4. Metal-insert rubber for draft shields around pedal openings, engine mounts, etc.
5. Hard rubber for steering wheels, etc.
6. Low cold flow rubber for engine mounts, spring shackles, etc.
7. Abrasion-resisting rubber for spring shackles, etc.
8. Oil-resisting rubber for coupling covers, steering-connection boots, etc.
9. Fabric and rubber compositions, as for top materials, body shims, check straps, etc.
10. Molded goods, as for grommets, spring and door bumpers, etc.
11. Sponge rubber for arm rests, ventilator seals, etc.
12. Cements for upholstery and mats, etc.



New type motor mounting recently developed by Chrysler. Square block in center is hard rubber which strengthens frame at motor mounts. Metal plates are dimpled to stiffen them and to increase the hold of the rubber to the metal.

In Three Years to

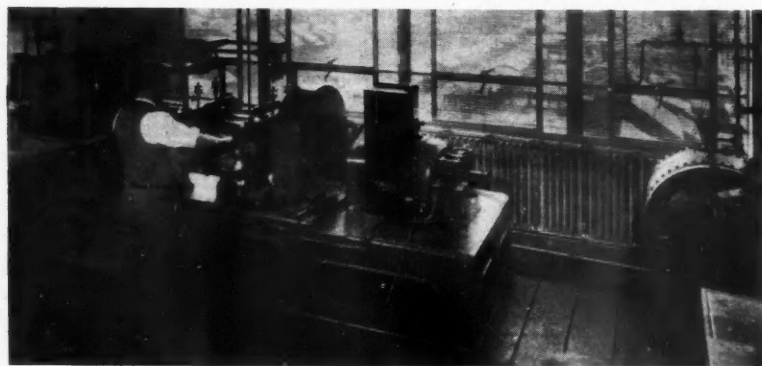
Numerous pieces and wide differences, excluding tires and tubes, have of engineers and rubber

By R. K. LEE and

These 12 groups, however, are not a complete classification of all rubber compounds used in the modern automobile. Take spring shackles for instance. In addition to being abrasion-resistant, they must have a low cold flow. Hydraulic brake hose, in addition to being reinforced with fabric, must be oil and pressure-resistant, etc. But by combining the physical specifications of the separate groups under which any rubber article might be classified, general rules for any specific rubber product can be obtained.

Before analyzing the various groups, it may be well to enumerate briefly some of the major constituents of different types of rubbers and their effect on the final product. Reclaimed rubber has come into use very extensively. Though the idea prevails that "reclaim" is used solely for the purpose of lowering cost, some "reclaim" sells at so high a price as to make it uneconomical to use it in cases where cost is a major consideration. This applies particularly to inner tube, and even more so to abrasion resistant reclaims. The quality and cost of reclaims and their adaptability to use in various automotive rubber products differ about as widely as do the characteristics of the various rubber articles themselves. As a result, some automotive rubber articles use a high percentage of reclaim, others none at all.

While on the subject of reclaims, it may be well to mention the three



A corner of the Chrysler rubber laboratory showing the vulcanizer at the right, the mill for compounding in the center, and a press at the extreme left

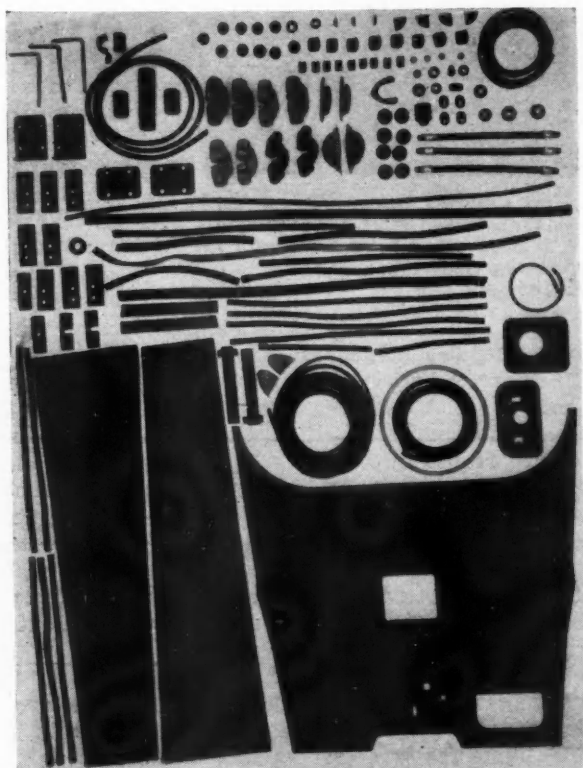
Production Have Increased a Multiplicity of Forms

*ence in design and composition,
grown out of cooperative effort
company research work.*

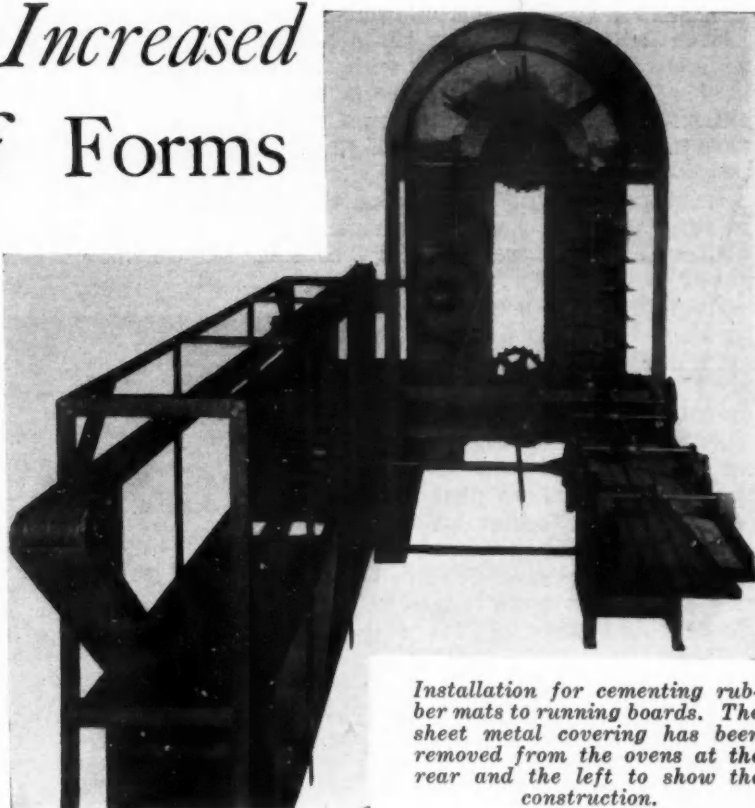
ATHEL F. DENHAM

principal methods of reclaiming rubber. One method involves the use of acid to dissolve the fabric and pigments. By the second, known as the caustic method, the rubber is plasticized, the cellulose constituents being converted into hydro-cellulose, which then mixes in with the rubber. This method also removes the sulphur. The third method consists in heating the material to plasticize the rubber. These three methods are frequently used in combination. After the plastic stage is reached, pigments and softeners are added to further process the compound.

Whiting, clay and barites are largely used as fillers for rubber compounds, where bulk at relatively low cost is essential. Zinc oxide is used where considerable resistance to abrasion and a low heat flow are desired.



This illustration gives an idea of the numerous different rubber parts used in an average automobile



Installation for cementing rubber mats to running boards. The sheet metal covering has been removed from the ovens at the rear and the left to show the construction.

Anti-oxidants which consist mainly of organic compounds are used to prevent depolymerization and oxidation with their deteriorating influences. Carbon black is used generally to increase the tensile strength of the compound.

Flat Molded Goods—Taking the first group, that of cheap, flat molded goods, an average compound contains 40 to 45 per cent of reclaim, with 10 to 15 per cent of softeners, such as pine tar, the remainder being chiefly pigment fillers. To be non-blooming, the goods should not contain an excess of sulphur. Paraffin can be added to the compound to prevent the formation of bloom.

A low-cost burlap is frequently used in flat molded goods to facilitate production. Since this type of rubber stock tears readily, being of low tensile strength, the burlap is inserted to give the strength needed when the stock is being drawn into the molding presses. The mesh should be wide enough to insure complete penetration of the fabric by the rubber. Otherwise the bond is quite likely to be imperfect.

Extruded Rubbers—Extruded rubbers vary widely in respect to the proportions of their ingredients. A good medium-soft quality extruded rubber would have approximately the following composition, based on 100 parts of rubber:

20 parts carbon black	5 parts mineral rubber
2½ parts sulphur	2 parts pine tar
8-10 parts zinc oxide	1 part stearic acid
	½ part accelerator

Mineral rubber is added to cause the stock to mix and extrude smoothly. The zinc oxide and stearic acid aid the accelerator. Stearic acid also aids in dispersing the carbon black.

The simplest means to decrease the hardness of this compound consists in replacing some of the rubber by

softeners and decreasing the pigments. Reclaim in itself will usually stiffen the compound, however, since the sulphur content of the reclaim (which has been broken down for recuring) has a hardening tendency. This characteristic will vary with the type of reclaim used, of course. The best type is inner tube reclaim, although other types, ranging from low-cost 85 per cent filler to friction reclaims of high gum content and high cost, may be used.

In connection with extruded parts it is well to keep in mind that the constituents must furnish the stock with sufficient inherent rigidity, so that when it is placed in the open curing heaters generally used, the parts will not lose their shape due to inability to support their own weight.

Wrapped Hose — This class of rubber compounds can be divided into four subclasses, namely, oil-resistant, pressure-resistant, heat-resistant and water-resistant. Naturally, some types of hose will require combinations of characteristics of the basic types.

In the first group, in order to insure the maintenance of fairly constant physical characteristics, a high percentage of reinforcing pigment is desirable, since pure rubber is attacked by oil. To provide resistance to oil, animal glue may be added.

Pressure-resistant hose stock approaches tire tread stock in its characteristics, the fabric acting as a reinforcing medium and resisting set and stretch. Hydraulic-brake hose is a high-grade example of both of the above groups.

Heat-resistant stock should have an inherently low cold flow. This can be obtained through the use of a fairly high content of carbon black, although an excess of carbon increases the cold flow again. The practical limit is approximately 45 parts of carbon to 100 parts of rubber. Accelerators in this type of compound must bring the product up to the desired tensile strength and—what is more important—hold it there. Excess sulphur is undesirable for that reason. If the combined sulphur content exceeds two to three parts to 100 parts of rubber, the tensile strength will drop. The correct amount of sulphur to insure a complete cure without excess is best determined by experiment.

The most important consideration in water-resistant hose is that whiting or zinc oxide must not be used in excess, as this material is soluble in water. Reclaims can be used, but should be low in hydro-cellulose content. Caustic reclaims are generally undesirable for this reason.

Metal-Insert Class—These high-grade rubber compounds can be divided into two general classes, those in which the load is transferred by mechanical fastenings

and those in which it is transferred by a bond between rubber and metal. The first group, in which the bonding problem is absent, does not call for the same rigid specifications as the second. In the latter the bond usually is due to a layer of sulphite formed between the rubber and an electrolytically deposited coating (either brass or copper) on steel. Accelerators are found to be extremely erratic: some work, others don't, but there is no general type of accelerator that may be expected to always work satisfactorily. Important requisites in these compounds are low mineral rubber and low paraffin contents, both of these constituents

having an unfavorable effect on the efficacy of the chemical bond. The uncured rubber should also be largely free from bloom, although sulphur bloom is generally not detrimental, except when in excess. In some cases it has been found to form excesses of sulphide, which weaken the bond. The moisture content should be low, to prevent oxidation. It has been found that moisture from the operator's hands may completely destroy the bond. For this reason it is highly advisable to coat the surface with rubber as soon as possible after plating to insure cleanliness of the metal. Of the two metals mentioned as most widely used for plating inserts, brass is generally more satisfactory, as it permits a faster bonding and does not seem to be as much of an oxidation catalyst as copper.

The effectiveness of the bond also appears to be dependent upon the proportion of zinc and copper in the brass plate, best results being obtained with a narrow range of brasses. The current density during the plating process also seems to have considerable effect on the final bond, slow plating

being preferable in general production.

Other factors affecting the bond are the pressure on the molds, location of the metal parts in the molds, and the mold design itself. Exceptionally high mold pressures are required to insure the forcing out of all air bubbles, so as to obtain 100 per cent surface contact between rubber and metal. This in turn makes it necessary to design the molds and the metal parts in such a manner that when the pressure is applied there will be no flowing action of the rubber. It is advisable to locate the metal parts by dowels rather than from outside dimensions.

A curious characteristic of bonded surfaces is that the strength of the bond increases with age over a period of about a week, so that results of tests conducted immediately after bonding will not be a true indication of the final strength.

Hard Rubber—Many of the troubles encountered
(Continued on page 238)



Placing a board on a mat in the aligning fixture. Following this operation operator will place it in the press, which is shown in the open position. Two men operating this machine will produce 2200 boards per day

Uses of Cemented Tungsten Carbide Extend Beyond Expectations

Recognition of factors involved in tooling practice for production results in manufacturing economies.

By JOSEPH GESCHELIN

INTRODUCTION of cemented-tungsten-carbide tools scarcely more than a year ago brought with it an upheaval of manufacturing methods in certain directions. In fact its value in mass production can best be gaged by recalling that it was almost immediately followed by a number of machines designed specifically for the application of this cutting material, as was strikingly illustrated at the Machine Tool Builders' Exposition held in Cleveland in October, 1929. Consequently it is only natural to find the widespread adoption of this new tool material attended by some of the grief resulting from lack of standardization and a limited knowledge of its limitations. To the shop man, particularly, it has been quite logical to learn that this material is better adapted to some applications than it is to others and that it is subject to definite limitations imposed by external factors that were not clearly evident at the outset.

Fortunately, a great deal of constructive and helpful information has crystallized from the experience of the men who have pioneered the application of cemented-tungsten-carbide tools in their plants. And it is the purpose here to present some of the ideas gleaned from actual contact with these men at their plants and also during the recent annual meeting of the S.A.E.

It is evident at once that cemented-tungsten-carbide is not a cure-all and should not be expected to replace carbon-steel tools and high-speed tools indiscriminately. Unquestionably this new material has remarkable potentialities and many new applications are still to be developed. Eventually, therefore, we shall have sufficient information by means of which we shall be able to specify the field for carbon steel, high-speed steel and cemented-tungsten-carbide.

Although at present there has been no standardization of tool forms for this material, a great deal is known about that phase of the problem, and engineers representing the manufacturers of this material now are prepared to make definite recommendations based upon studies of each individual job. That tool form is highly critical has been demonstrated time and time again and the difference of as little as 2 deg. in the slope of a cutting edge has spelled the difference between success or failure.

Tool form depends on many factors, among which are the character of the material to be machined, the available surface speed, and feed and

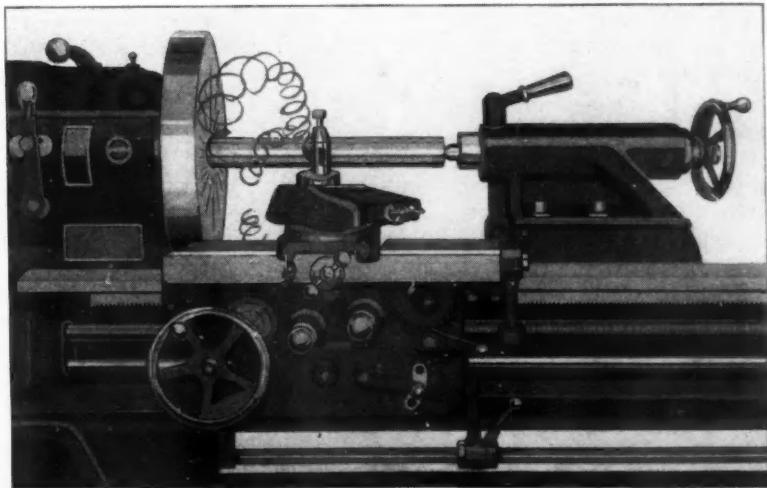
depth of cut—all of which are critical and inter-related. Variability of practice in this regard makes it almost impossible to generalize and certainly impossible to standardize on tool forms.

Mounting of cemented-tungsten-carbide tool tips is a vital factor in the life of the tool. It is now known that a specially designed mounting and one that will support the tool securely and relieve it of most of the strain is absolutely essential. The method of fastening the tip is also of paramount importance, for of the two accepted methods, namely, welding and brazing, the latter seems to be the most successful in the majority of cases, the explanation being that the brazed joint forms an elastic bond which absorbs deformations due to temperature change and stresses induced by cutting. The market now affords a number of patented tool mountings, although in many cases the manufacturer of the tool has facilities for mounting and can supply the entire tool unit ready for use.

Knowing the importance of the tool form, we can appreciate the necessity for maintaining it accurately when regrinding is necessary. Initial handicaps in the use of the new tools were caused just by the lack of proper grinding facilities and technique. Now it is possible to buy grinders especially designed for the purpose and grinding wheels of a special grade and bond. Two methods of grinding are offered, the fixed method where the tool bit is accurately clamped in a vise and the free-hand method. The former is preferred especially now that new machines have been adapted for the purpose. The actual necessity for the fixed method is obvious when it is considered that it offers an accurate means of forming the cutting edges of the tool. In some instances a honing operation is necessary after

grinding the tool to form. This is especially indicated in the case of piston grooving tools, where satisfactory results are absolutely dependent upon a perfectly honed cutting edge.

Accumulated experience definitely indicates that surface speed should be high, much higher than is current practice in cutting with high-speed steel and in most cases beyond the practical



range of old machines. This, then, is one of the first limitations that is encountered. Feeds should be slower than is usual. According to well-informed production men and also in the experience of the engineers for the manufacturers of these new cutting tools, the relation of speed and feed is easily the most important factor, yet through lack of information this has been sadly neglected in many instances. As a matter of fact, some of the unsatisfactory jobs may be directly attributed to an improper selection of speed or feed, or of the combination.

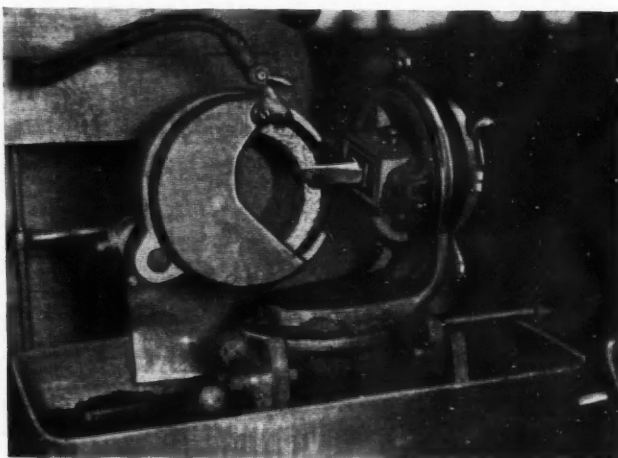
Available machine tool equipment in the plant is easily the determining factor to be considered. Most of the old tools now in use are incapable of delivering the high speed required, thereby definitely limiting the usefulness of the new tooling. Again, the condition of the machine is very important, for even if the machine is capable of giving the high surface speed required, it may not be sufficiently rigid. And any looseness in the bearings—any tendency to chatter—will be absolutely fatal to the tool. On the other hand, some very successful installations have been made on old machines which were overhauled or rebuilt because the reduced feed helped to minimize the stresses imposed by the heavier feeds used with high-speed steels. New machines naturally simplify an important phase of the problem, since they are better designed and provide more rigidity and higher speed, thus permitting maximum utilization of the new tools.

That the introduction of cemented-tungsten-carbide may prove to be a real boon to foundries and to the manufacturers of drop-forgings, was voiced by several prominent speakers at the S.A.E. annual meeting. The new tools will cut through scale and hard spots with such facility that these points need no longer trouble the foundry and forge shop. Less finish may be allowed and rejections due to these causes may be minimized or almost entirely eliminated. Consequently, there is a new possibility of savings starting with the raw material, which, coupled with economies in manufacture, will combine to effect a marked reduction in overall cost. Again a word of caution is necessary, for while cutting tools properly supported cut scale and hard spots with facility, this does not apply to drills and reamers, tipped with cemented-tungsten-carbide.

Manufacturing economies with this new material are usually associated with greater speed and depth of cut. Nevertheless, it must not be overlooked that in many cases real economy lies in the life of the tool, between grinds and between setups. In many instances, the application is well worth while chiefly because it eliminates tool breakdowns and in this fashion speeds up production. To cite an ordinary case, Howard Jones of the White Co. stated at the S.A.E. production session that one cemented-tungsten-carbide tool has machined 50,000 pistons without requiring resharpening.

With the present development of the art, the most successful applications have been made in cutting non-ferrous metals, particularly aluminum, copper and bronze. Cemented-tungsten-carbide has also worked

well on cast iron but has not given general satisfaction on steel: in fact it seems best not to do too much with steel for the present. The best explanation for this appears to be that the tool is hampered by the limitations of the old machines. Evidently the old machines are not capable of carrying the heavy loads attending the machining of steels at high speeds and cause the tool to fail by permitting it to "chatter" due to lack of rigidity. On the other hand, even with new machines, these tools have been required to take very deep cuts, with the result that the period between regrinds has been substantially reduced.



A review of the factors affecting the application of cemented-tungsten-carbide tooling gives the machine the place of prime importance since the design and mechanical condition of the machine will largely determine the success or failure of the experiment. And it is well worth noting that many prominent automotive manufacturers have found it advisable to install new equipment capable of the maximum utilization of this material. The remarkable economy effected by this cutting material is a matter of common knowledge, and as a direct result its use is finding wide-

spread application throughout the automotive field. However, it is plain to see that any new application requires careful study for best results; accordingly it is found advisable to consider a new application as being truly experimental and keep it divorced from actual production until the production man is satisfied that all of the variables have been interrelated to the best advantage. After this has been done the tool can be accepted as a standard and satisfactorily adapted to production.

Welding Stainless Steels

THE National Advisory Committee for Aeronautics, Washington, D. C., has just released the following two technical memoranda dealing with the latest developments in the welding of stainless steels:

Technical memorandum No. 531, Welding Rust-Proof Steels, by W. Hoffman.

Technical memorandum No. 532, Welding of Stainless Materials, by H. Bull and Lawrence Johnson.

The authors discuss the chemical analysis, physical properties and welding characteristics of various types of stainless materials, the chief of which are (a) high and low chromium content chrome steel and (b) chrome nickel steel. They stress not only the desirability, but the actual necessity of carefully selecting the alloy best suited for the conditions and point out that the chief determining conditions are: physical properties, resistivity to corrosion, and nature of service. It has been demonstrated that stainless steels can be welded readily by the oxy-acetylene process. Also, that the welds produced by the gas flame or by the electric arc process are more rust-proof than the base metal itself.

Just Among Ourselves

Trucks Show the Way to Smoother Merchandising

HOW things have changed! Time was not many years ago, when any automotive man looking for horrible examples of merchandising difficulties, troublesome trade practices and miscellaneous marketing jumbles was prone to turn to the motor truck end of the business for his material. Unsound financing methods, horrible trade-in policies and other selling evils were the featured stars of the truck firmament a few years back.

The truck industry still has some troubles, to be sure, but the passenger car end of the business is too busy putting its own house in order to have any time to cast aspersions on its less aesthetic cousin. With the car makers in the midst of arguments and readjustments as regards dealer policies of every conceivable kind, the truck builders seem to be going merrily along, taking their business hurdles in stride and doing nicely, thank you.

While car stocks in dealers' hands were being increased more than 150,000 last year, truck dealer stocks were decreasing slightly. Maybe that has something to do with the changed situations.

* * *

The Search for "Ability" in New Dealers Continues

A SMALL group of automobile men, including the chief sales executives of two passenger car companies and an important distributor of one of those companies, was discussing the now time-worn question of the chances of the average automobile dealer to make money under present-day conditions.

"Capital and ability—that's all a fellow needs today or ever did need to make money from an automobile dealership," said this distributor, who has made several millions from the business himself.

That nearly ended the argument. Nobody disagreed. How could they—unless somebody wanted to start down the long trail of discussion which would have been ahead had somebody arisen to demand a definition of that elusive quality so glibly referred to as "ability." All definitions which come readily to mind involve the use of words even less meaningful than the word "ability" itself.

The only definition one could get a group of automobile men to agree upon probably would be a post facto one—"If a dealer operates his business at a profit, keeps his franchise and stays in business over a long period of years, he has ability." But that one won't help the factory field man much in his search for new dealers with "ability."

* * *

The Industry Refuses to be Middle Aged

AS all Cabell fans know long since, the whimsical James Branch has appended to his latest book, "The Way of Ecben," an interesting statement of why, in his opinion, a man should stop writing when he reaches the age of fifty—which age, he himself has reached. The discussion contains scores of delightful Cabellisms, many of them touching on the ever interesting topic of youth vs. old age.

One of them, which applies to attitudes of mind as well as to mere physical ages, runs like this:

"Youth is credulous in many matters, but upon one single issue youth stays as iron and

granite: youth does not even believe that life serves well enough as it stands. To believe that such is just possibly the case remains the attested hall-mark of middle life."

One strength of our automotive industry probably lies in its refusal thus far, at least, to become middle aged.

* * *

The National Show and Stock Prices

THERE is a general belief—somewhat similar, we think, to the ground hog and his shadow myth—that automobile security prices increase every January during the automobile show periods. We have it on our mind for a long while to make a statistical check of this belief, going back a number of years; the idea still is on our mind.

We did get sufficiently ambitions, however, to get compiled some data covering the 1930 show period. This year at least the general theory was borne out.

The average price of 16 leading passenger car stocks was 2.7 points higher on Feb. 2, 1930, than on Jan. 2, 1930.

The average price of 20 leading parts and accessory stocks was 3.6 points higher on Feb. 2 than on Jan. 2.

The increase in average price of the car stocks was 7.7 per cent; in the average price of parts and accessory stocks, 12.2 per cent.

Out of the 16 passenger car stocks studied, 11 went up, 2 went down and 3 remained the same. Of the 20 parts and accessory stocks studied, 18 went up and 2 went down. None of the 4 stocks in the two groups which declined went down as much as one full point.—N.G.S.

Rapidly Fluctuating Pressures By Indicator Combined

The importance of selecting a frequency is stressed. The tion to pressure

By E. J. MARTIN

Physicist and Research Engineer,

NEARLY two years ago the authors described¹ a new type of indicator developed at the General Motor Research Laboratories. Since that time it has seen much use and considerable development. It is an indicator which is almost entirely electrical in its operation, and produces its records by means of an oscillograph. It has characteristics which should make it useful for measuring rapid pressure fluctuations in many fields of research as well as that of automotive engineering.

When the type of phenomenon to be recorded by it, as well as the conditions under which it must operate, are considered, the difficulties of designing a good indicator are easily appreciated. The rapid pressure fluctuations, especially during detonation, require that the indicator be very quick in its response, in order to prevent objectionable phase lag and error. The sudden pressure variations prohibit the use of tubes leading from the combustion chamber to the indicator because of the surges set up in them. These surges are very violent in tubes having diameters which are small enough not to change the compression volume materi-

ally. The necessity of mounting the indicator flush with the inner wall of the combustion chamber requires that its operation be unaffected by the high engine temperatures. It is also necessary that the recording mechanism of the indicator have small mass, so that inertia forces set up by engine vibration will be small compared with those due to engine pressure. When mechanical devices must be attached to the engine for driving any part of the indicator, such as recording drums, mirrors, etc., they should be very simple so as not to introduce lost motion or difficulties of operation.²

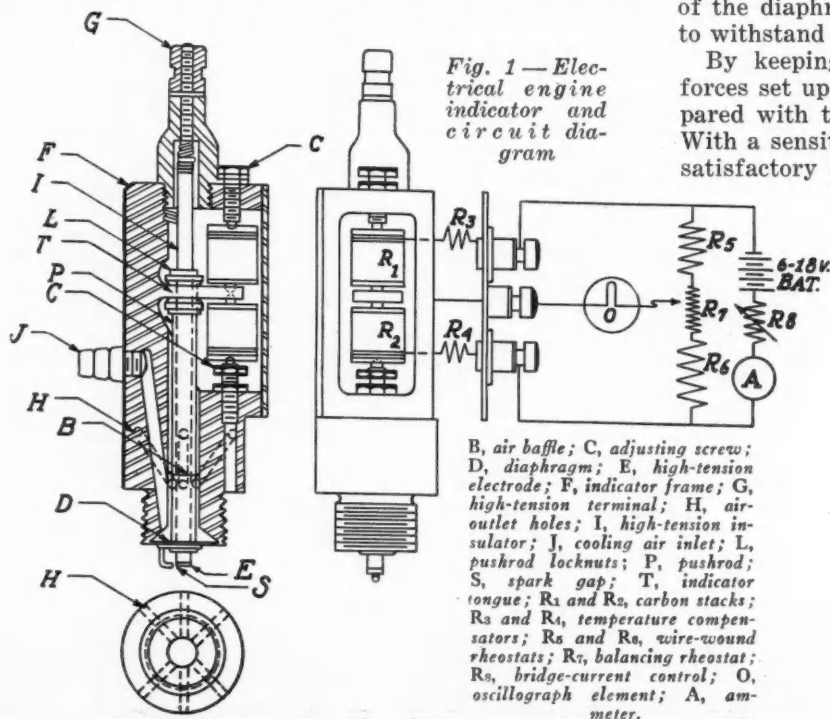
Fig. 1 is a sketch of an indicator and the bridge circuit which it controls. The tongue *T* (cantilever spring) is machined integrally with the frame from a block of good spring steel which is carefully heat-treated after all machining except grinding is completed. By means of a hollow invar steel push rod *P*, the tongue is coupled to the thin steel diaphragm *D*, which is brazed to the end of the threaded adapter which forms part of the frame. This adapter is designed so that when screwed into the cylinder head the diaphragm is flush with the inner wall of the combustion chamber. The thickness of the diaphragm is not any greater than is necessary to withstand the pressures to be measured.

By keeping the diaphragm fairly thin, the elastic forces set up in it during operation are negligible compared with those set up in the stiff cantilever spring. With a sensitive oscillograph the carbon stacks produce satisfactory deflections for tongue and diaphragm dis-

placements well under 0.0005 in. Consequently, heating of the diaphragm does not appreciably affect the calibration of the instrument. The cantilever spring is located where there is not sufficient heat to change its calibration.

The life of the diaphragm is long, usually well over 100 hr. of actual testing. This is due to the small displacement and to cooling, which is effected by directing a stream of air against it, as shown in Fig. 1. A machinist can replace the diaphragm in an hour or two.

Besides long life, the small movement of the recording parts practically



¹ S.A.E. Journal, July, 1928, page 87.

² For a more complete discussion of the characteristics of indicators, see the S.A.E. paper referred to above.

Measured *Electrically* With Spark Plug

sensitive oscillograph of high effect of long tube connect-element discussed.

and D. F. CARIS

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eliminates friction and lost motion. It also makes easy the design of indicators having high natural frequencies. The indicators of this type constructed up to date have frequencies ranging between 3500 and 11,000 cycles per second. This characteristic makes them particularly suited for any research in which rapid pressure changes are to be recorded.

The first carbon stack indicators were constructed to screw into a hole drilled into the cylinder head for this purpose. In work requiring pressure measurements at selected points or simultaneous measurements at several points, the boring of special holes is, of course, unavoidable. For a large amount of work, however, it seemed desirable to design an indicator which could be screwed into the spark plug hole and serve both as a

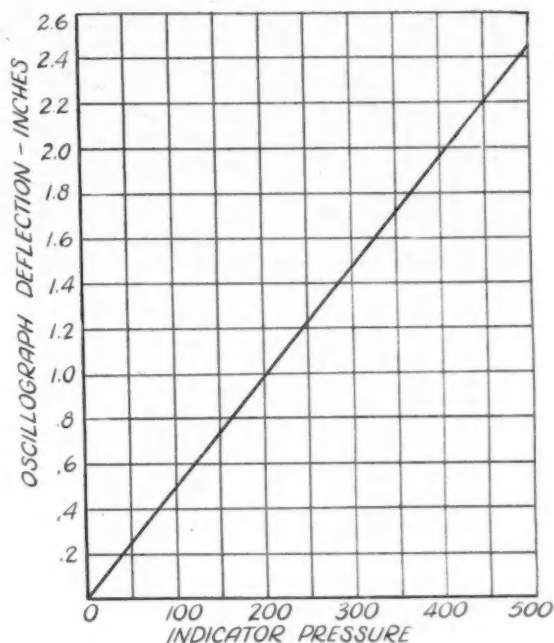


Fig. 3—Calibration curve. Observation points, all of which are on "curve," have been omitted

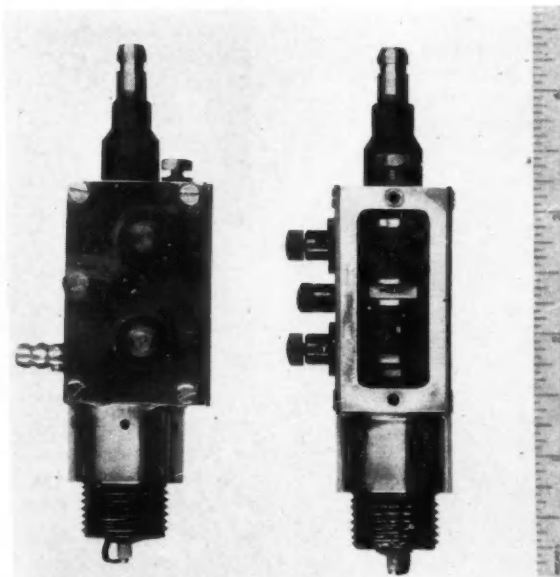
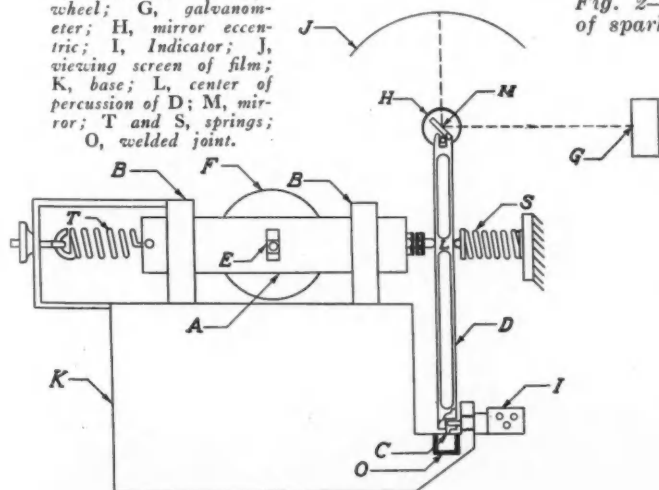


Fig. 2—Two views (above) of spark plug type indicator

Fig. 4—Dynamic calibrating device (below)

A, reciprocating bar; B, bearings; C, pivot point of D; D, oscillating bar; E, eccentric; F, fly-wheel; G, galvanometer; H, mirror eccentric; I, Indicator; J, viewing screen of film; K, base; L, center of percussion of D; M, mirror; T and S, springs; O, welded joint.



spark plug and an indicator. The small displacement of the push rod and diaphragm made this development rather simple (see Fig. 1). Instead of using a hollow push rod closed at its lower end, a rod open at both ends is used. A high-tension wire which serves as the "core wire" of the "spark plug" is connected by means of a very light spring to the terminal G (insulated from the frame by a bushing) and extends down through the push rod and ends at E, one electrode of the spark gap. The other gap electrode is the same as in a spark plug. The "core wire" is insulated from the push rod by a tube made of insulating material similar to that used in spark plugs. This insulating tube and the core wire are fixed in place by means of spark plug cement. The insulating tube is tested for flaws before assembly. Indicators made in this way do not cause preignition and have proved to be as satisfactory for pressure measurement and to last as long as the non-spark plug type. The increase in the mass of the moving element still leaves the frequency well above the limit of mechanical oscillographs.

Fig. 2 shows two views of a spark plug indicator. The indicator is calibrated by connecting it and a standard pressure gage to a chamber in which the pressure is varied by admitting air from the pressure tank. Readings of the pressure gage are plotted against corresponding deflections of the spot on the oscillograph



Fig. 5—This curve shows the relation between indicator tongue displacement and oscillograph deflection with pushrod contacting bar during full stroke. Several complete cycles are represented

screen. By means of the valves, the pressure is quickly brought to a desired value, the gage and spot are read, and the pressure is immediately reduced to zero before another point on the curve is obtained. This procedure is followed because there is a tendency for the stacks to take a set when subjected to a steady pressure for too long a time. In order to avoid this "creeping effect" it is best to bring the pressure up and back as quickly as possible. That this effect is negligible or zero for rapid cycles was shown by performance tests to be discussed below. The accuracy of calibration can be improved by substituting for the oscillograph a millimeter having the same resistance, because the position of the spot on the screen cannot be read as accurately as its trace upon the film, nor as accurately as the meter.

After careful tests the earlier models of the indicator were found free of temperature effects. Due to much greater compactness of design and to a change in the quality of the carbon stacks now procurable, it is necessary to provide compensators which keep the effects of temperature negligible. This is done by connecting a small resistor in series with each carbon stack. Each resistor is so small that one is mounted inside the frame of the indicator near each carbon stack. The wire used in the resistors has a high temperature coefficient. The use of the compensators requires no changes in the indicator dimensions and as far as the operator is concerned their presence may not be suspected. That the results are satisfactory is shown by the calibration curve in Fig. 3. This curve was obtained by housing the reducing chamber and indicator in an oven.



Fig. 6—This curve shows the relation between indicator tongue displacement and oscillograph deflection with pushrod contact interrupted near one end of stroke. (Several complete cycles)

Although the natural frequency of the indicator is, or can be made, sufficiently high to reproduce faithfully pressure wave forms which are beyond any other device of this kind, there may be some doubt about the ability of the carbon stacks themselves to respond to such frequencies. Besides the question of mechanical hysteresis, one might ask to what degree the device is damped, because damping is very important in any recording instrument. To answer such questions as these, a series of performance tests were made, using the apparatus shown in Fig. 4, which was designed to give the moving element of the indicator known displacements of the order of 0.0005 in. The steel plate *A* is given a simple harmonic motion by means of the eccentric *E*, which revolves on a 2½-in. shaft ground to fit large, carefully reamed bearings. A flywheel is mounted between the bearings which are supported 12 in. apart on a heavy base. Any lost motion that might exist is taken up by spring *T*. The shaft is driven at various speeds by means of a 2-hp. motor.

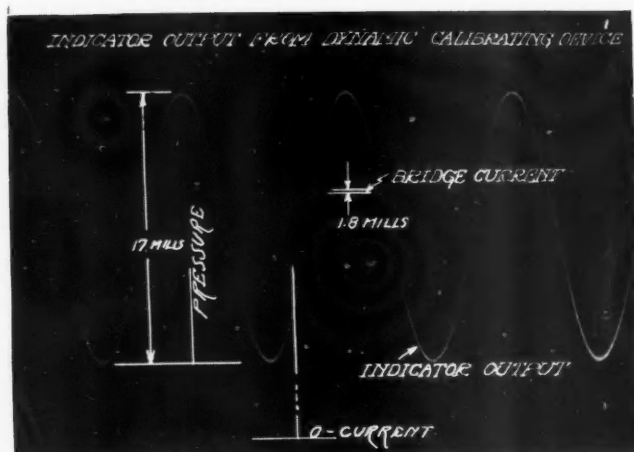


Fig. 7—Output from indicator when given a simple harmonic displacement by means of dynamic calibrating device

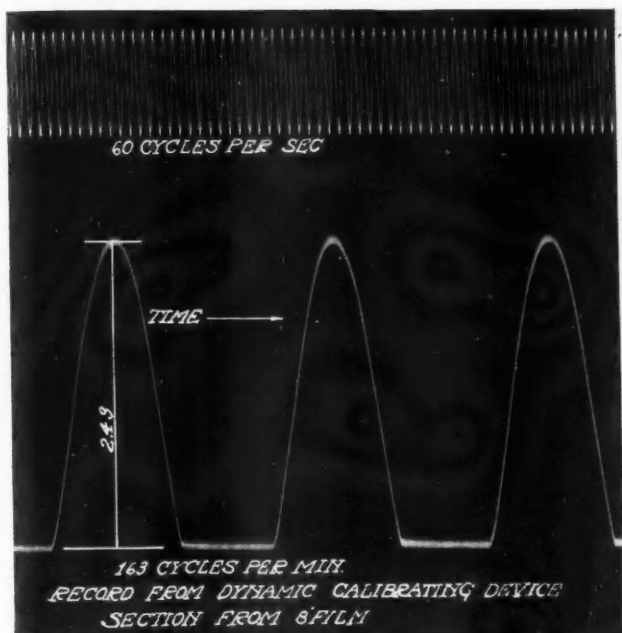
A pin having a spherical end projects from the plate *A* and bears against the lever *D* at its center of percussion *L*. A spring *S* holds the lever in contact with the pin at all times. The lower end of the bar ends in a pivot (hinge) which is machined integrally with the bar and the steel block *O*. This block is brazed into the heavy plate *K* which is bolted to the base of the driving apparatus. Near the pivot a hole is bored into the neutral axis of the lever and the inner end ground flat.

The upper end of the lever is connected to a plane mirror *M* so as to make it oscillate about an axis perpendicular to the plane of the sketch, care being taken to avoid lost motion. An oscillograph galvanometer is mounted at *G* so that the beam of light from its mirror is reflected by *M* to the screen *J*. The screen holder, mirror and galvanometer are inclosed in a light proof housing so that photographic films can be substituted for the screen. The apparatus as a whole is very rigidly constructed and weighs about 400 lb.

Each indicator tested was provided with a pushrod having a spherical end which projected beyond the diaphragm a sufficient distance to bear against the ground bottom of the hole in the lever when the indicator was mounted as shown at *I*. The indicator and bridge were connected in the usual manner to the oscillograph galvanometer *G*. With this arrangement the curve traced on the screen represented indicator output (galvanom-

eter deflection) plotted against a displacement proportional to that of the indicator tongue. It should be noted that this apparatus represented engine conditions quite well in that the force was applied in one direction only, the recovery depending on the characteristics of the indicator alone.

In these tests care was taken not to favor the indicator. If it had been screwed in tightly against the oscillating lever it would have worked over a range considerably removed from its normal zero, and consequently would have stood a better chance of reproducing the motion. To prevent this, the bridge was first balanced, and with the lever at its extreme left position the indicator was screwed in until a slight deflection of the oscillograph showed that the pushrod was making contact. Fig. 5 is a typical curve obtained with it mounted in this manner. Besides showing a linear



Figs. 8 (9 and 10)—Sections cut from 8 ft. film showing output from indicator when the pushrod was given a simple harmonic motion by means of the dynamic calibrating device. The pushrod was allowed to make contact with the bar during little more than half of each cycle

relation between displacement and deflection, the curves showed hysteresis to be negligible. By screwing the indicator back slightly, contact between the pushrod and lever was interrupted when the latter was to the left of its central position. In other words, the displacement had the form of a rectified sine wave. Curves obtained in this manner (see Fig. 6) showed that the indicator does not "overshoot its zero" when the force is suddenly removed.

The tests mentioned above were repeated, using a regular oscillograph instead of the galvanometer unit; oscillograms being taken in the usual manner. Fig. 7 shows the output from the indicator when screwed in so as to be in contact with the bar at all times. Figs. 8, 9 and 10 are cut from an 8-ft. film taken with the indicator screwed back slightly. While the film was being exposed the speed of the motor driving the bar was increased from 163 r.p.m. to 1800 r.p.m. The constancy of the deflection and of the zero line, as well as absence of a tendency to "overshoot the zero," is well brought out.

Although the above tests show fairly conclusively how

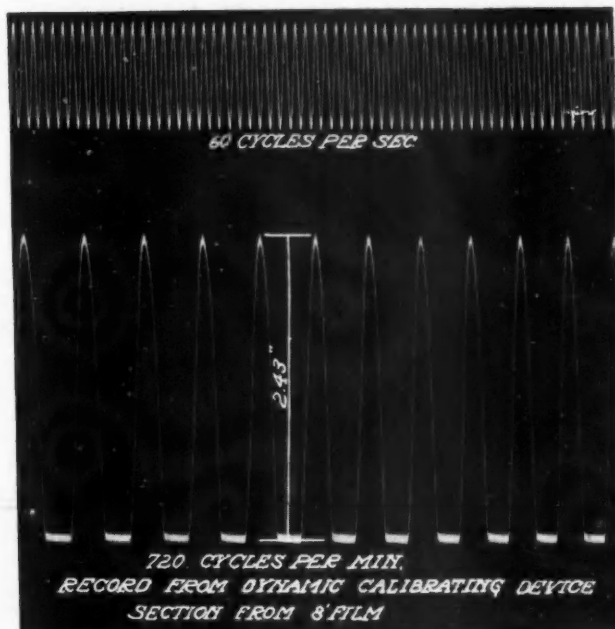


Fig. 9—Output from indicator at 720 cycles per min.

the indicator performs at frequencies up to 1800 cycles per minute, it is appreciated that they should have been extended to several thousand cycles per second in order to cover the range over which this indicator is theoretically capable of working. The difficulty of producing known forces having good wave form at these frequencies is considerable. By measuring the frequency and the damping factor of the indicator when completely assembled, its characteristics at all frequencies can be computed by assuming that it is to be used with an oscillograph adequate at such frequencies and that the displacement-resistance characteristics of the stacks are

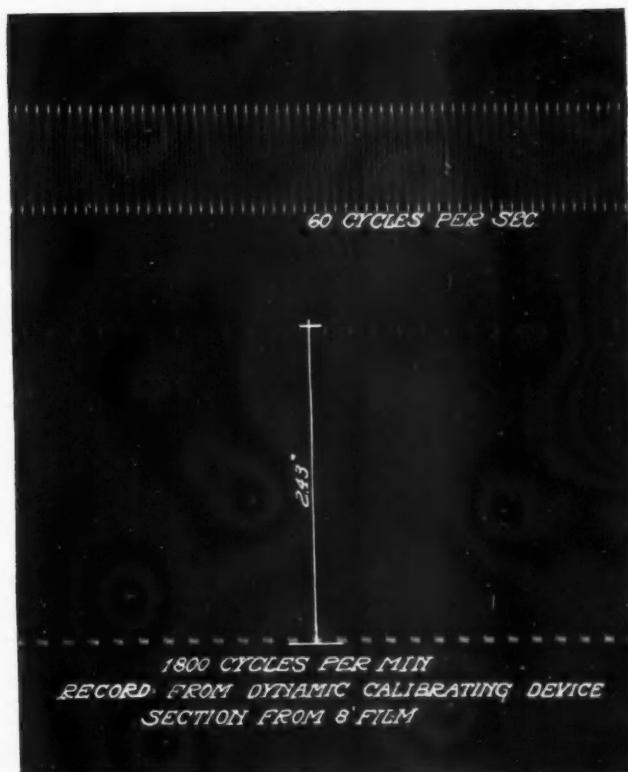


Fig. 10—Output registered at 1800 cycles per min.

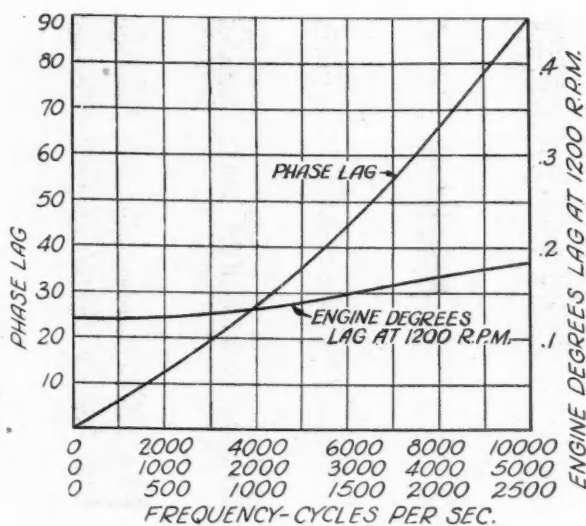
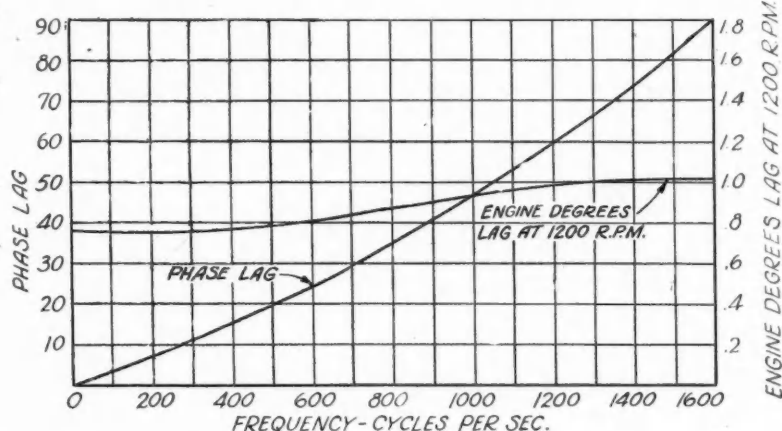


Fig. 11 (above)—Curves showing indicator lag

Fig. 12 (right)—Curves showing oscillograph lag



independent of the frequency. Although at present experimental difficulties prevent a thorough study of the stack characteristics at such high frequencies, there is no reason for believing that their response is affected seriously. In studying the effects of cylinder head vibration on the indicator we have recorded damped sinusoidal oscillations at frequencies as high as 5000 per second. The fact that measurement of these records showed that the damping followed the exponential law indicates that the stacks are probably adequate at frequencies up to 5000 at least.

A series of experiments were made in which the tongue of the indicator was displaced to one side and then suddenly released. In doing this the point of a screwdriver or a corner of a file was used in much the same manner that the "pick" is used on a mandolin string, except that the force involved was much greater. The oscillograph records obtained in this manner varied somewhat, depending on the oscillograph element used. In all cases, however, the records were the same as those obtained by suddenly opening the oscillograph circuit when the bridge was adjusted so as to be out of balance. This showed quite definitely that the speed of recovery as obtained from the records depended on the oscillograph characteristics. In other words, the above tests showed that this method of measuring pressure is limited by the frequency range and damping characteristics of the oscillograph.

The above experiments did not yield any information concerning the damping present in the indicator. To arrive at an estimate of this damping, another series of experiments were made in which the pushrod was clamped in a vise so that the frame served as a mass which could be set into vibration. With this arrangement the frequency of vibration and the damping were sufficiently low to be recorded by an oscillograph. The frequency and damping coefficient were easily computed

from the records by measuring two amplitudes, the frequency and substituting in the following:

$$\frac{a_1}{a_2} = \frac{(c t / 2 M)}{e}$$

where M is the mass of the frame and t the time required for the amplitude to diminish from a_1 to a_2 .

By using the value of c computed from the above equation and assuming that it does not change with the frequency, the damping coefficient, $c/2m$ (where m is the effective mass of the tongue and pushrod) was calculated. The value of $c/2m$, arrived at in the above manner, was approximately equal to half the undamped frequency of the tongue and pushrod as computed from the static deflection produced by a known force. From this it follows that the damping present in the indicators is approximately 50 per cent of critical. It is certainly

safe to assume that they are not seriously over-damped so as to be sluggish in response. Fig. 11 shows the phase angle (lag) in degrees plotted against frequency for indicators having resonant frequencies of 10,000, 5000 and 2500 cycles per second respectively, as shown at the bottom of the sheet. The other

curve represents the lag in degrees of crankshaft rotation for an engine running at 1200 r.p.m. This second curve shows that in terms of crankshaft rotation, all

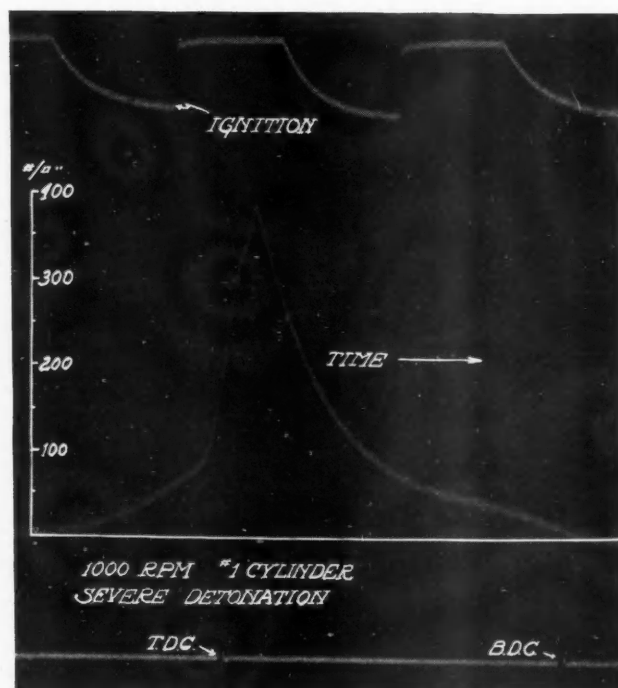


Fig. 13—Single card showing detonation. Note peculiar shape of the peak and total absence of oscillation

components having frequencies within the range plotted lag very nearly the same amount. In other words, the whole indicator card is displaced by very nearly the same amount, which could easily be allowed for if it were appreciable. This does not mean that all frequencies in this range are recorded in correct proportion to their amplitudes. Near the resonance frequency for the indicator the error amounts to as much as 15 per cent. The resonance frequencies for the indicator constructed so far are so high (3500-11,000 cycles per second, depending on the design) that components of the pressure wave having frequencies of several thousand cycles per second could be recorded with very small error, provided suitable oscillographs could be built.

Fig. 12 is the same as Fig. 11 except that it applies to one of the oscillograph elements used for indicator work in this laboratory. It shows that if the damping is somewhat better than 50 per cent critical, the whole indicator card is displaced by the same amount. It also shows that the lag introduced by the oscillograph is considerably greater than that introduced by the indicator.

In some work the engine head itself vibrates in much the same manner as the head of a drum. This vibration does not occur except in the presence of detonation. Its frequency is always high and depends on the design of the cylinder head. If the indicator frequency happens to be too near that of the cylinder head, the record often has a high frequency wave superimposed upon it when the engine is operated under detonating conditions. Besides making the trace faint and difficult to read, this superimposed wave might also conceal important features of the record. Therefore, for some investigations it becomes necessary to suppress the effect of cylinder head vibration.

A low-pass electrical filter connected in series with the oscillograph has solved the above problem very well. It practically eliminates all frequencies above 2000

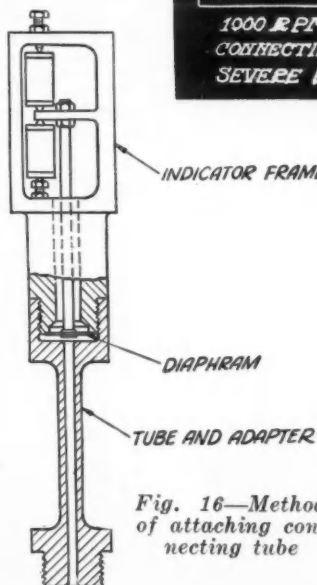


Fig. 16—Method of attaching connecting tube

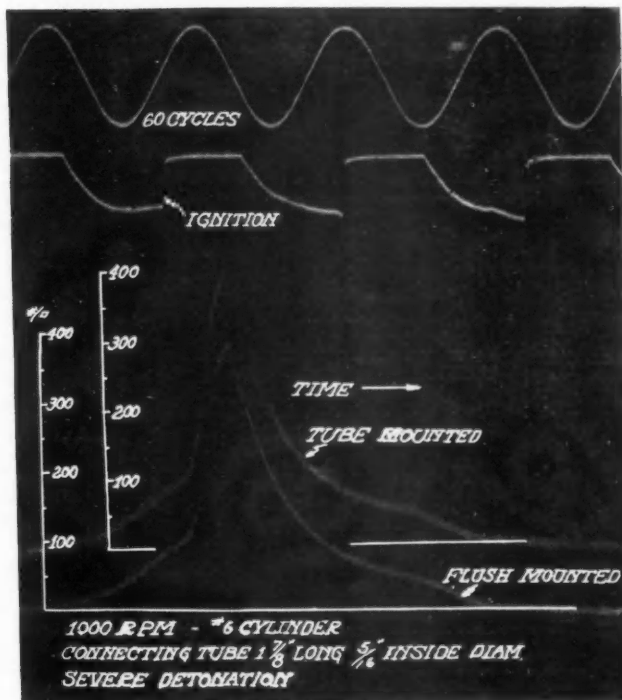
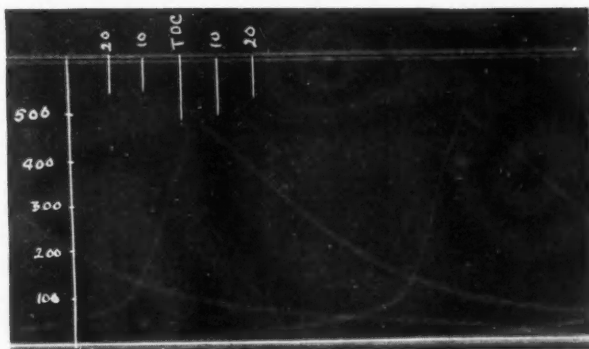


Fig. 17—Cards showing surges introduced by a tube having dimensions similar to the one used in connection with the Farnborough indicator

cycles per second and offers very little impedance at frequencies below 1600 cycles per second. It is left in the circuit during the calibration of the indicator and affects its sensitivity to a very small extent.

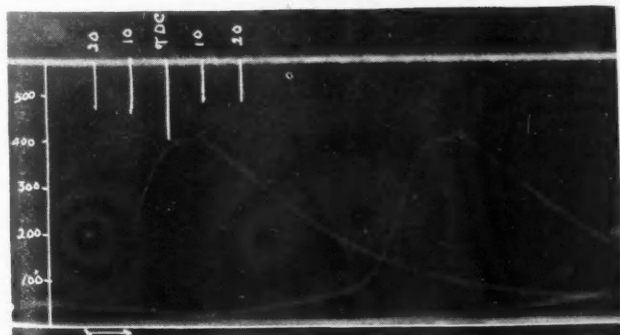
In order to show how the indicator performs, and perhaps to assist the reader in forming a conception of events which may occur in the combustion chamber, a few typical records are shown (see Figs. 13 to 15). No explanation in addition to that given with the records is necessary, except in the case of Fig. 13, which was taken on an engine that was detonating. Owing to the use of indicators lacking the proper characteristics, many engineers believed that detonation was characterized by pressure surges ("detonation waves") set up in the combustion chamber immediately after peak pressure occurred. The cards looked like normal indicator cards with damped sinusoidal waves having comparatively low frequencies superposed just after the time of peak pressure. Since early in its development the new indicator has always shown that these "detonation waves" were not characteristic of combustion, but were due to oscillations set up momentarily in the indicators which had been used. Fig. 13 shows that detonation does affect the card considerably, but no suggestion of a

Figs. 14 (right) and (below) 15—Indicator diagrams showing the effect of lead tetra ethyl. (Not enough was added to completely remove detonation)



Speed, 800; fuel, gasoline; load, 15 lb.; spark, 30 deg.; mixture ratio, 80% air

Speed, 800; load, 15 lb.; spark, 30 deg.; fuel, 3 cc./31 gal.; mixture ratio, 80% air



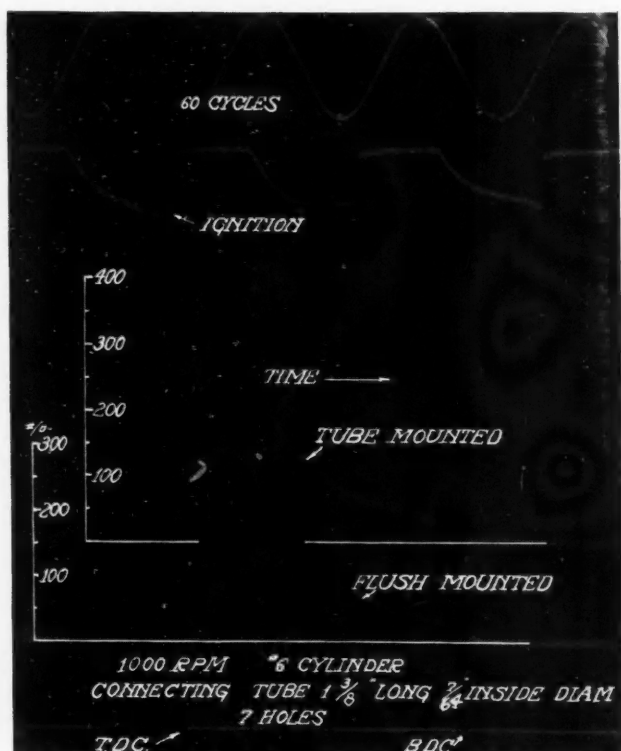


Fig. 18—Showing the pressure oscillations caused by the tube used with the Bureau of Standards indicator

"detonation wave" can be seen. If such a wave exists its frequency must be extremely high or its amplitude so small compared with engine pressures that it does not show up in the records, in which case it could have very little significance in combustion theory.

All these typical cards were taken with spark plug

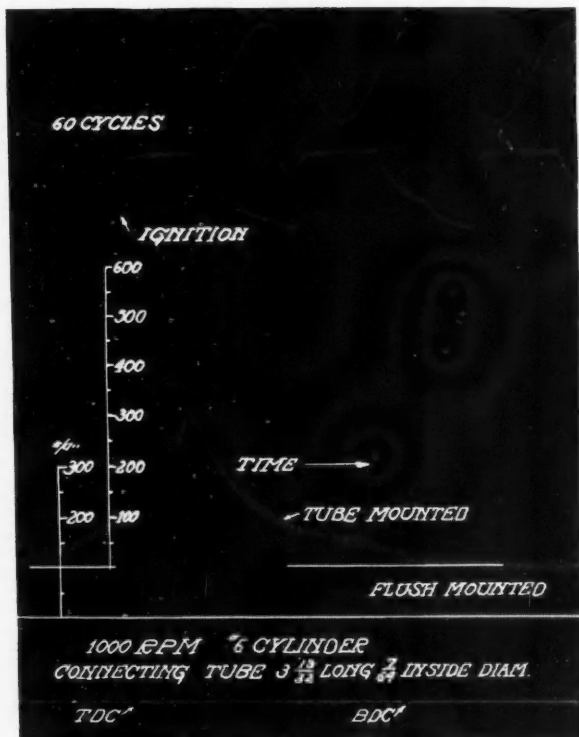


Fig. 19—Oscillogram showing the effect of a connecting tube similar to that used on Collins micro indicator. Note extreme distortion caused by tube

indicators of the type illustrated in Fig. 1 (Page 230).

It has long been suspected that the use of tubes for connecting indicators to the combustion chamber has resulted in errors that might be serious. An estimation of such errors is difficult, because during the compression stroke they become partly filled with the combustible mixture which must explode in the tube itself. No method has been discovered by which pressure surges set up in a tube under such conditions can be computed in advance. Since nearly all the indicators used by engineers at present are connected to the engine by means of tubes having various dimensions, we are presenting some records which show quantitatively the surges set up in such tubes. These records also demonstrate "quickness of response" on the part of the new indicator.

In this work two indicators were used, care being taken to make them equally sensitive by proper adjust-

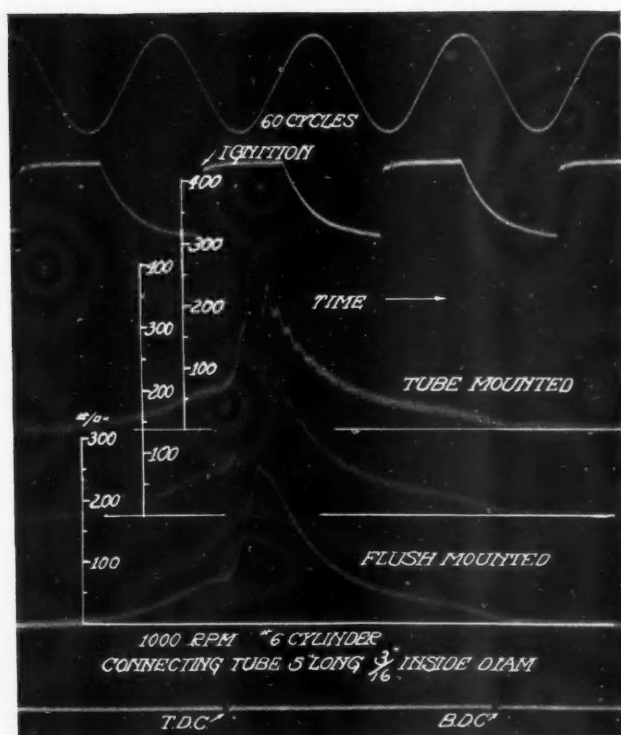


Fig. 20—Records from two electrical indicators at the end of a tube similar to that used on a De Juhasz indicator compared with one mounted flush

ment of the bridge currents. In all cases one indicator was mounted flush with the inner wall of the combustion chamber. The other was mounted at the end of a series of tubes having dimensions equal to those used in various indicators. Each tube took the form of an adapter as shown in Fig. 16. The adapter was screwed into a hole near the one in which the first indicator was mounted. In this manner pressures in the combustion chamber and those at the end of the tube were recorded on the same film (see Figs. 17-21).

In general it can be said that the surges in the tubes become more violent as the speed of combustion increases. In the presence of detonation the tube surges are often several times as high as the maximum pressure developed in the combustion chamber. The indicators with which tubes must be used do not show these surges in their records because they are too slow in their response to pressure. Some operate so as to "build up" the record by using parts taken from several hundred cycles. The resulting "composite card" is some

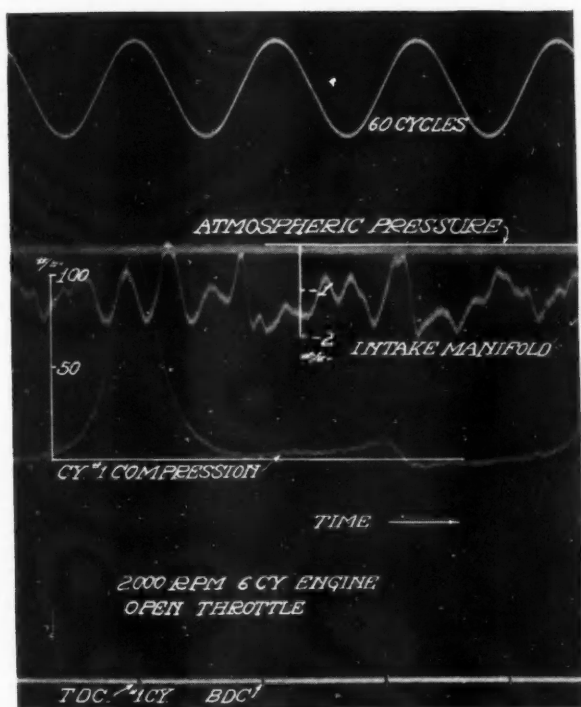


Fig. 21—Low pressure indicator record of intake manifold pressure while the engine is being driven by the dynamometer at a speed of 2000 r.p.m. open throttle

sort of a statistical mean of a large number of cards. Owing to sluggishness, leakage, friction, slow action of valves, etc., and trouble from vibration they fail to show the fineness of detail that is needed for research.

When properly designed, this type of indicator is well adapted to the measurement of low pressures such as occur in manifolds, etc., Sensitivity is very important for such work, and consequently the diaphragm is somewhat larger than is used with the regular indicators. A record taken with an indicator designed for low pressure measurement is shown in Fig. 21.

STEEL FOR AUTOMOBILE BODIES

(Continued from page 223)

ing operation. Cold rolling is a more drastic form of cold work and consequently longer intervals may elapse before the metal will recover from the effects of the overstrain thus produced.

"Obviously, then, if a local annealing operation is necessary between two deep drawing operations, precautions must be taken to prevent the whole stamping from being heated, otherwise stretcher strains may occur in the second operation.

"As the result of the plastic behavior of steel in the overstrained state," the authors remark, "the apparent 'strength' of cold worked steel is decreased on account of the ease with which a permanent 'set' may be produced. In the experience of the authors, it has been found desirable in some cases, to heat the steel slightly after forming in order to hasten the recovery of its elastic properties. An example showing the necessity of such a treatment was in the manufacture of locking rings. These are split rings sometimes used to lock automobile tires to the rims. After the steel had been rolled into the desired circular shape, it was found that the elasticity necessary for the proper functioning of the ring was lacking. Only a slight force tending to

spread the ends of the ring was necessary to produce a permanent distortion of the ring. Heating it, however, for a short time at about 300 deg. F. completely restored the elasticity."

"There is another phase of the phenomenon which is worthy of mention. As has already been pointed out, the irregular lines of depressions 'disappear' when the steel is elongated well beyond the yield point because the effect of contrast diminishes as the stretch increases until the entire surface has been affected. If, however, any previous local deformation has occurred, such as might be produced by kinking in cold rolling or roller leveling, etc., subsequent drawing, provided, of course, that ageing of the metal has taken place, will not remove the traces of the local deformation even though the yield point is greatly exceeded. In this case, the locally deformed areas will stand in relief, after drawing, as ridges or slightly raised veins since they do not elongate as much as the surrounding metal.

"During the drawing of a steel in this condition, a new set of stretcher strains may appear, and disappear when the metal has been elongated well beyond the yield point, but the occurrence of these may be prevented by roller leveling.

"Sheet or strip steel may be prevented from exhibiting the effect of such local deformations and ageing by annealing at approximately 1100 deg. F."

The authors then point out that the deep drawing qualities of strip and sheet steel are dependent not only upon the physical properties of the metal but also on the type of deformation. They state that in their experience the adaptability of the steel for deep drawing is influenced more by the size of the grains than by any other factor; also that a small rather than a large grain size is more adaptable for most deep drawing operations whether they be in strip steel or sheet steel.

Another important influence of grain size is that after deep drawing a sheet metal having a large grain size will exhibit a coarse granulated surface which will require filing and polishing operations, the degree of coarseness being directly proportional to the grain size. Brittleness is another somewhat unusual condition described by the authors. According to them, "A steel having a large grain size is subject to the phenomenon known as 'Stead's Brittleness' more often than a steel of small or medium grain size. This is a peculiar type of brittleness which sometimes occurs in low carbon steel. It occurs on annealing after cold working and is due to the crystalline grains assuming the same, or nearly the same, orientation.

"As a result, the cleavage planes are almost in a straight line. Steel in this condition is very susceptible to fracture by dynamic stresses. Cases have been cited by Stead where fracture has occurred by simply dropping the metal on the floor. Fractures resulting from this type of brittleness usually occur when the major stress is at 45 deg. to the direction of rolling. Thus a steel may draw perfectly in a preliminary operation and then exhibit extreme brittleness in a subsequent operation in which the application of the stress has been from a slightly different direction. Straightening or flattening of stampings by means of trip hammers often causes fracture of steel in this condition. Fig. 5 is a photograph of a portion of a stamping made from a steel which exhibited this type of brittleness and shows the profile of the fracture obtained."

"Sheet metal having too small a grain size exhibits in too great a degree the property already referred to as 'toughness,'" observe the authors. "On account of its high yield point and tensile strength, the work necessary to form a steel of this kind is sometimes so great as to make its use prohibitive by the ordinary methods.

Uses of Rubber in Automobile Production

(Continued from page 226)

with hard rubber, especially when used in combination with steel, are traceable to its high rate of heat-expansion, which may be 16 to 30 times that of steel. An example is the hard rubber steering wheel with its steel core. To offset the normal high expansion rate, asbestos and other fibrous materials are often added. The addition of thermoplastics other than hard rubber also helps.

Low Cold Flow—Low cold flow rubber compounds, which are particularly desirable for rubber shackles, motor mounts, etc., can best be obtained by specifying high tensile strength and hardness. While these physical characteristics in themselves will not assure a good cold flow rubber, they will keep out the very bad ones. Other specifications which assist in the reduction of cold flow are the provision of high gum content, say 66 parts, high carbon black for hardness, and some zinc oxide for heat flow. While rubber compounds having less resistance to cold flow can be used by offsetting the lack of specific resistance by an increase in the area of the part, cost consideration will generally indicate the inadvisability of pursuing this course. If the specific resistance to cold is high, less rubber and less metal are required.

Abrasion-Resistant Rubbers—Since this characteristic in a rubber compound is frequently needed in combination with low cold flow, as in spring shackles, it is logical that the requirements for low cold flow compounds of the latter type should frequently apply also to this group. For pure abrasion-resistant qualities, a high zinc oxide and a high carbon black content are desirable. Accelerators should be carefully selected and proportioned to provide a cure up to the tensile strength needed, without excess of cure. It is frequently possible to add reclaimed rubber, provided it is of good quality. If it is used, however, it is advisable to insure hardness by further increases in the carbon black content.

Rubber-Fabric Compounds—This group comprises the calendered stocks, and in most cases, such as that of top materials, should have a high cold flow, best obtained by the addition of softeners. If reclaim is used, it should be of good quality. High-temperature accelerators have been found most satisfactory. Tensile requirements in the rubber itself are not important, as this characteristic is supplied by the fabric.

Characteristic of the calendered stock, which requires a lower cold flow, is body shims. It is not necessary to go to extremes in this, however, as the laminations formed by the cotton fabric in the shims increase the resistance to cold flow

in themselves. The smaller the distance between layers of fabric, the higher the resistance. The use of more fabric, therefore, enables the use of lower-cost rubber stocks, with an actual increase in rigidity. From a cost point of view, however, there is a definite limit to the amount of fabric or number of laminations, for after a certain point is reached, it will be found more economical to increase the quality of the rubber stock rather than the number of laminations and, therefore, the amount of fabric.

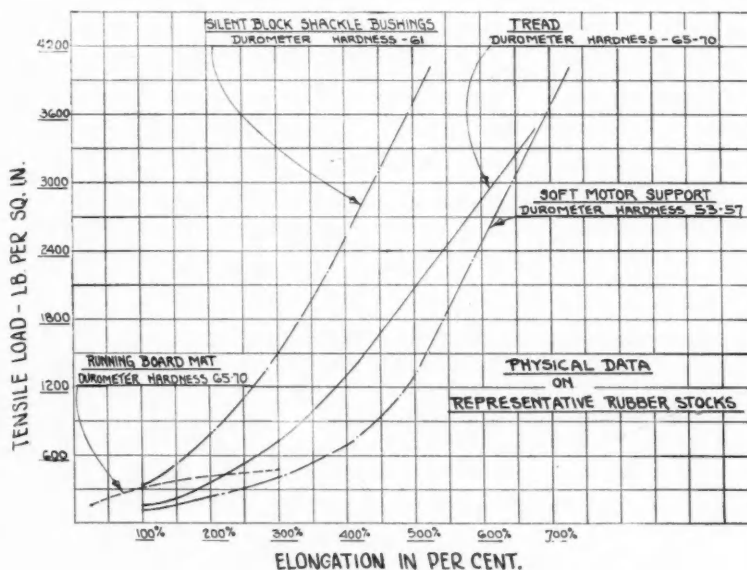
Molded Goods—Although molded goods have been classed under one head, these stocks vary widely in composition, character and cost, according to the purpose for which they are used. In the lowest-cost group are such parts as grommets, which do not require any unusual physical characteristics. The major requirement is that they should hold their shape. Therefore, a fairly low grade of reclaim can be satisfactorily used in nearly all cases.

Spring bumpers, which in the past have been classed rather generally in the lower-cost group of molded goods, have been improved considerably in quality for greater effectiveness by increasing the gum content, thereby their resistance to cold flow and impact. For the latter characteristic the important consideration is to use a stock of high tensile strength and without well-defined grain structure, to prevent fracture. High percentages of zinc oxide are beneficial from this point of view.

Door bumpers also come under the same general head as spring bumpers. Rubber boots for chassis parts (for universal joint connections, for instance) should be of a still higher grade of rubber stock, with high tensile strength the chief consideration. In most cases the requirements for oil resistant stocks apply here also.

Hydraulic-brake cups for sealing brake cylinders involve special considerations, since in addition to pressure and oil-resistant qualities, they must also be unaffected by alcohol and acid (free and combined oleic and stearic acid in the castor oil used). Reclaims should

not be used for these parts, as their composition is not sufficiently susceptible to control. Accelerators must be carefully selected so that they will not react with either of the acids found in the castor oil used in brake mechanisms. It has been found that the cup edges obtained by molding cannot be relied upon to provide a perfect seal, and machined edges are therefore required by Chrysler. Other characteristics specified by this company for these parts are that the tensile strength should be



Relation between tensile load and elongation for characteristic rubber compounds. Based on data obtained in tests carried to the breaking point

not less than 4500 per sp. in., and that permanent set should not exceed 2 to 3 per cent after a tensile break and 10 min. recovery.

Sponge Rubber—Sponge rubber is formed by the addition of such compounds as sodium carbonate or ammonium carbonate and fatty acids to the uncured stock which react to form gases within the stock when heat is applied.

Rubber Cements—The chief requirements made of these rubber compounds are that they should be resistant to moistures, and set and age well.

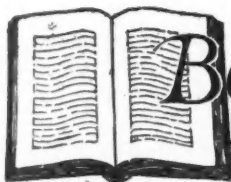
Effect of Sunlight—Sunlight has the well-known effect of oxidizing the surfaces of rubber compounds and reducing the tensile strength. This characteristic is particularly noticeable in many of the stocks with high pure gum content, this constituent being highly sensitive to light. To reduce the oxidizing effect, pigments should be carefully selected to reduce the absorption of light, especially where the use of pigments is limited by physical requirements. Accelerators and anti-oxidants should also be carefully selected to blend with the pigments and softeners used to prevent the penetration of light beyond the surface. The use of pine tar is inadvisable, since it softens under light to a considerable extent. The cracking of top materials,

which frequently occurs after prolonged exposure to any light containing ultra-violet rays, such as sunlight, is also traceable to overcuring of the stock—something that should be carefully avoided.

Design Considerations—Some observations may be added in regard to the designs of rubber products whose functioning is vitally influenced by size and proportions, such as shackles, motor mounts, etc. Decreasing the thickness of the rubber in a bonded structure, such as used in vulcanized engine mounts, increases the load on the bond in lb. per sp. in., as it decreases the deformation under load.

In mounts generally, the deflection rate is best controlled by dimensional changes, although the curing rate has a considerable effect. Fast curing stocks are not desirable, as they increase the risk of overcuring.

Measurements of physical characteristics of production rubber compounds should always be performed on instruments in use at the assembling factory, or on instruments calibrated from these, as instrument readings are generally not comparable. This applies especially to Durometer hardness readings. It is hoped that this situation will be overcome in the near future, as developmental work is now being carried out by the A.S.T.M. on instruments which will give more nearly permanent and individually comparable results.



Books for the Business Bookshelf

The Angular Distortion of Crankshafts

By C. A. Norman and K. W. Stinson. Bulletin No. 43 of the Engineering Experiment Station of the University of Ohio.

PROFESSORS Norman and Stinson have made some experiments to determine the torsional deflection of crankshafts and have sought to derive a formula connecting the deflection with the torque applied and the dimensions of the elements of the crankshaft. Torsional tests were made on a six-cylinder engine with four different extra crankshafts, which were furnished by the Continental Motors Corp. Formulas were developed for the deflection of each part with the shaft under a given torque, and these were checked by means of the results of the deflection tests. The results were compared also with data and formulas given by B. C. Carter in an article which was published in *Engineering* of London for July 13, 1928.

Marketing Used Cars

By Paul G. Hoffman and Dr. James H. Greene. Harper Bros. Illus. \$3.00.

THE vice-president of the Studebaker Corp. combines factory sales experience and activity over many years as a Pacific Coast distributor, retailer and salesman in his discussion of this phase of the automobile business. He reminds dealers that used-car selling should have either direct supervision, or the supervision of their highest paid executive. The basic thought of the book is that only through careful reconditioning can the dealer in moderate and high priced used cars hope to cope successfully with competition of low-priced new cars.

In a foreword, C. A. Vane, manager of the National Automobile Dealers' Association, calls it a volume for the dealer who works soundly and hard, and who is looking for organized common sense. Mr. Vane's conclusion is borne out by a chapter showing that market-

ing of used cars is a business and not a problem. The authors say that the fact that there are about one and one-half used cars sold for every new car proves that there is a market for used cars that deserves careful consideration.

"When the merchandising of used cars ceases to be regarded as a problem—and is considered as a necessary part of the retail automobile business, the problem disappears."

Dr. Greene was director of the Bureau of Retail Training at the University of Pittsburgh before joining the Studebaker organization as head of its cooperative department. He is author of "Organized Training in Business."

N. A. C. A. Report No. 326

By E. P. Lesley and Elliott G. Reid.

THIS report describes the tests of five adjustable blade metal model propellers both in a free wind stream and in combination with a model fuselage with stub wings, which were conducted at Stanford University under research authorization of the National Advisory Committee for Aeronautics. The propellers are of the same form and cross section but have variations in radial distributions of pitch. By making a survey of the radial distribution of air velocity through the propeller plane of the model fuselage it is found that this velocity varies from zero at the hub center to approximately free stream velocity at the blade tip.

The tests show that over the working range the efficiency of a propeller when operating in the presence of the airplane is generally less than when operating in a free wind stream, but that a propeller with a radial distribution of pitch of the same nature as the radial distribution of air velocity through the propeller plane suffers the smallest loss in efficiency.

NEW DEVELOPMENTS—Automotive

Fuller Five-Speed Truck Transmission

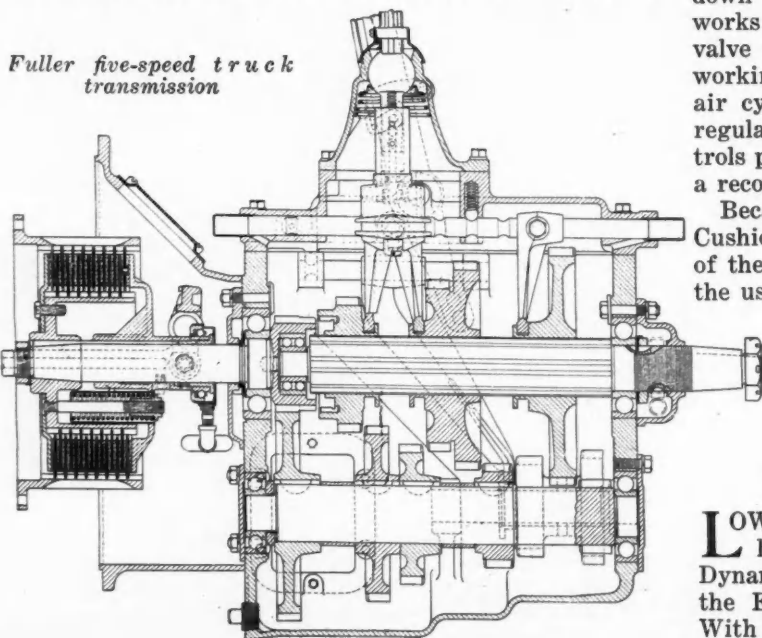
A HEAVY-DUTY transmission giving five forward speeds and two reverse, and controlled entirely by a single lever, has been announced to the truck industry by Fuller & Sons Manufacturing Company, a Division of Unit Corp. of America. In addition to three sliding members on the splined shaft the two reverse pinions also form a sliding member. The shift lever has four fore-and-aft planes of motion corresponding to the four sliding members, but can be latched out of the two extreme positions by thumb latches.

Two combinations of five forward speeds are offered. In one there are four reductions and a direct drive and in the other three reductions, a direct drive and an overdrive. Ratios are as follows:

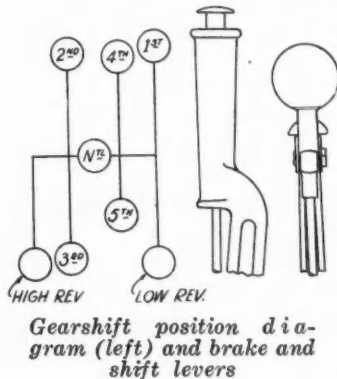
Speeds	Standard	Overdrive
5th	direct	direct
4th	1.76	.781
3rd	2.87	2.04
2nd	4.79	4.2
1st	8.07	7.07
High reverse	4.73	4.14
Low reverse	8.62	7.55

Under ordinary operating conditions only four forward speeds are to be used, starting with second. Shifter forks for high reverse on one side and low reverse on the other extend some distance from the center line of the transmission and they are guided by shafts inside the transmission below and to the side of the regular shifter bars.

Ball bearings are used on the clutch shaft, main shaft



Fuller five-speed truck transmission



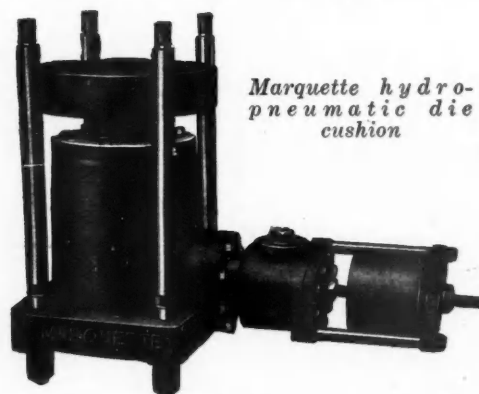
Gearshift position diagram (left) and brake and shift levers

and counter shaft and there is a double row ball bearing on the main shaft pilot. Flanges are furnished to fit standard S.A.E. bell housing Nos. 1, 2 and 3 and provision is made for a power take-off.

Hydro-Pneumatic Cushion

IN deep drawing operations or when working heavy metal, it is sometimes desirable to use greater blank-holding pressure than it is practicable to supply with air-operated equipment. The Marquette hydro-pneumatic die cushion made by the Marquette Tool & Mfg. Co., Chicago, Ill., is designed to meet this need, and, in operation, it effects the same economies as pneumatic cushions, plus a wider range of pressure.

As the name implies, this cushion operates with a liquid in conjunction with hydraulic inlet and outlet valves which are timed from the crankshaft of the press.



Marquette hydro-pneumatic die cushion

A slight pressure of air behind the liquid serves to raise the piston of the cushion to its original position after each stroke of the press. This cushion is fitted with a combination check and air actuated relief valve. On the down stroke of the press, the piston of the cushion works the liquid back through the relief ports of the valve to the auxiliary tank, against a predetermined working pressure. The relief valve is controlled by an air cylinder, making it necessary to adjust only the regulating valve connected with the cylinder. This controls pressure evenly, and makes possible the keeping of a record of pressure which may be duplicated later.

Because of their compact design, Hydro-Pneumatic Cushions can be installed on presses where limited space of the bed construction or foundation would not permit the use of adequately large air cushions. Considerable practical information concerning applications of hydraulic and hydro-pneumatic cushions will be found in the Marquette handbook "Better Stampings."

Dynamic Braking Controller

LOWERING of crane, ore and coal bridge, and bucket hoists is said to be facilitated by the Wright Dynamic lowering circuit controller, manufactured by the Electric Controller & Mfg. Co., Cleveland, Ohio. With this new circuit, the brake releases immediately;

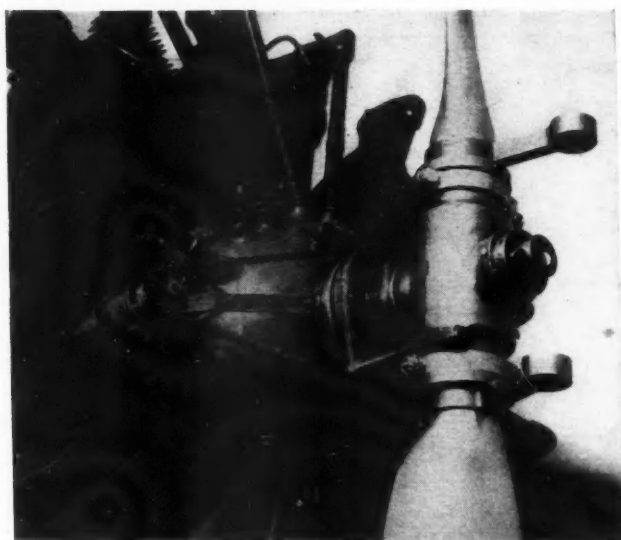
Parts, Accessories and Production Tools

moreover, it passes all of the line current through the brake. Among the advantages claimed for this circuit are the following: faster speed when lowering light loads; greatly reduced power consumption; lower heating of motor; reduced current peaks, and less contactor wear.

Adjustable Pitch Propeller

FLIGHT tests with a new variable-pitch propeller invented by A. K. McLeod of Oakland, Cal., were made recently on a Fokker Super Universal plane owned by the Aero Corp. of California. Mr. McLeod was assisted in the development of the propeller by C. M. Fuller, president of the Richfield Oil Company of California.

The propeller consists of standard duralumin blades which are secured to the hub by a steel ferrule placed over the shank of the blade. The ferrule is kept in place by a buttress thread and locked by the control pin which extends through both the shank of the blade and the steel ferrule. Control arms extending parallel with the axis of the propeller operate the pin, these control arms being moved in an axial direction by means of a yoke and an operating lever. The photograph shows a different and obviously a later control mechanism comprising a chain and sprockets. A dial on the instrument board in the cockpit shows the angle to which the blades

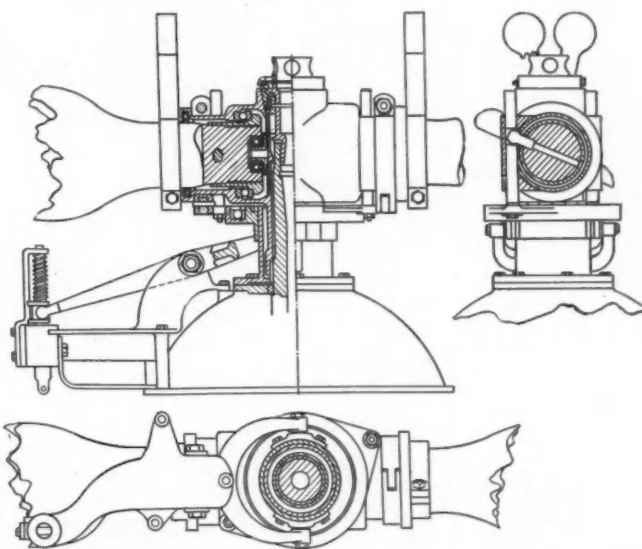


The McLeod propeller, mounted

of the propeller are set to within two minutes of a degree.

One of the difficulties encountered in operating variable pitch propellers is that when the pitch is to be increased a large thrust load must be overcome by the operator. In the McLeod propeller this difficulty is overcome by the provision of a pair of counterweights, shown in the illustrations, which are said to reduce the effort required on the control member to a few pounds.

In operation, when starting the engine the pilot sets the propeller for zero pitch and warms up the engine without producing any propeller blast. When he is ready to take off he sets the control for a pitch slightly less than normal, and this operation automatically opens the



Plan drawing of McLeod variable pitch mechanism

throttle. The engine then develops its maximum horse power and the propeller its maximum thrust per horse power. At the end of the climb the pilot advances the control to increase the pitch and at the same time partly closes the throttle so as to reduce the engine speed to its normal figure. At 20,000 ft. altitude, where the density of the atmosphere is only about half that at sea level, the pitch may be further increased to make it possible to utilize the full power of the engine.

Electric Combination Machine

GENERAL operations such as burring, turning, beading, slitting and flanging on steel sheets up to 18 gage may be performed on the No. 172 Niagara Electric Combination Machine recently announced by the Niagara Machine & Tool Works, Buffalo, N. Y. Among the features of this machine are the following: It operates from any electric light socket; the frame rigidly houses the motor and incloses all gears and clutch parts; the clutch gives instant control either by hand lever or foot treadle or can be locked for continuous operation; switch with overload protection mounted on the frame. This machine is supplied complete with clutch, $\frac{1}{4}$ hp. A.C. Motor, electric switch, ten feet of cord and plug, wrench, foot treadle for shaft motion and foot treadle for clutch control.



No. 172 Niagara electric combination machine

TURNING with cemented tungsten carbide tools and a description of the Carbo-Lathe are covered in a booklet entitled "Turning With Tungsten Carbide," recently published by the Porter-Cable Machine Co., Syracuse, N. Y. Interesting information is given on the uses of this new cutting tool material.

Automotive Oddities

by Pete Keenan



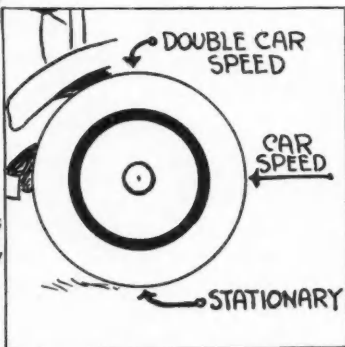
LIEUT J.H. DOOLITTLE. DOES A LOT. WHILE STUNTING FLEW THE WINGS OUT OF HIS PLANE. HE SAVED HIS LIFE BY A PARACHUTE JUMP OBTAINED A RIDE OF SEVERAL MILES BACK TO AERODROME. CALMLY ASKED FOR A PLANE. AND FINISHED HIS STUNTING. *Cleveland 1929*

THOMAS H. SHEVLIN. WAS THE FIRST MAN ARRESTED FOR SPEEDING. AT MINNEAPOLIS. THE DAREDEVIL WAS FINED TEN DOLLARS FOR GOING OVER 10 MILES AN HOUR.

SPEED LIMIT
10 MILES
by Doolittle



RANSOM E. OLDS GOT HIS BIG KICK OUT OF BUILDING A STEAM CAR FOR AN INDIAN POTENTATE. THE SHIP SANK ON THE WAY TO INDIA WITH THE CAR. AND AS MR OLDS SAYS SAVED HIS REPUTATION.



HOW A WHEEL TRAVELS.



PENNSYLVANIA DESTROYED THE FIRST NUMBER THIRTEEN LICENCE PLATE AS NOBODY WANTED IT



IN 1902 CHICAGO. PASSED AN ORDINANCE THAT MOTOR VEHICLE DRIVERS MUST NOT WEAR EYE GLASSES. SPECTACLES WERE PERMITTED.

First with
the News

Reliable,
Accurate

News of the Industry

PAGE 243

VOLUME 62

Philadelphia, Saturday, February 15, 1930

NUMBER 7

Trucks, Buses Aid Railways, is View

Chairman of I. C. C. Cites
Their Value in Short
Hauls

WASHINGTON, Feb. 13—Contrary to the general view, trucks and buses are helping the railroads so far as net profits are concerned, in the opinion of Chairman Frank McManamy of the Interstate Commerce Commission. These classes of motor transportation, he pointed out, take care principally of short-haul traffic, which is not profitable to the railroads owing to the two-terminal services.

The head of the commission expressed this opinion recently when with Commissioner Ernest I. Lewis and Secretary George B. McGinty, he appeared before a subcommittee of the House Committee on Appropriations in connection with hearings in which the commission and other independent branches made request for appropriations for the forthcoming fiscal year. Chairman McManamy gave his opinion of railroad-motor competition in reply to a question by Representative John C. Allen, Republican, of Illinois.

The head of the commission went on to say that motor buses are taking away a large part of passenger business, but that passenger business, "if we are to accept the statement of the railroads, has not been profitable for years, so that has not reduced their net." Trucks, it was declared, have taken away a great deal of short-haul freight traffic, "but leaving to the railroads the more profitable long-haul traffic."

"Of course," said Chairman McManamy, "there has been a very great increase in the movement of traffic as a whole, and if that all went to the railroads and they were organized to meet it, possibly their earnings would be better. I cannot say as to that. But

(Turn to page 246, please)

Kaltwasser Is With Timken

DETROIT, Feb. 12—C. M. Kaltwasser, formerly vice-president and general manager of the Spicer Corp. and of the Salisbury Axle Co., has been acting in the capacity of vice-president of the Timken Detroit Axle Co. since Jan. 15.

Plan Aero Museum at German Airport

WASHINGTON, Feb. 13—The history and development of aeronautics from the earliest beginnings to the present day will be demonstrated in a new aeronautical museum to be opened at the Berlin-Tempelhof airport at the end of February, according to a report received in the Aeronautics Trade Division, Department of Commerce, from Assistant Trade Commissioner A. Douglas Cook at Berlin.

Protests Rail Advertising

WASHINGTON, Feb. 13—Street car signs warning of alleged tribulations of motoring, such as parking problems, etc., and suggesting that automobiles be left at home and street cars be patronized were the object of attack by the Washington Automotive Trade Association at a meeting here last Monday night. A resolution, offered by Rudolph Jose, one of the directors of the association, declared that such cards carried by the Washington Railway & Electric Co., and the Capitol Traction Co., constituted unfair advertising. Announcement was made by Whitney Leary, president of the association, that he would appoint a committee to investigate the matter in the hope of reaching some agreement with the traction companies.

AC Reports Sales Gain

DETROIT, Feb. 12—January sales of AC products set new records, substantially exceeding any month in the history of the company, Harlow H. Curtice, president, declared today. Mr. Curtice added that there has been a 35 per cent increase in the number of productive employees since Jan. 1, and that practically all departments of the company are now working on a full-time basis.

Curtiss Showing New Plane

NEW YORK, Feb. 11—The Curtiss Wright Corp. will show for the first time at the St. Louis Exposition when it opens this week the newly developed Curtiss Kingbird, a seven or eight-place twin engine cabin limousine for private owners. The Kingbird is a high-wing, externally braced monoplane powered by two Wright Whirlwind air-cooled engines mounted in outboard nacelles.

M. & E. A. Plans New Publicity Campaign

National Advertising of "Care
Will Save Your Car"
is Feature

CHICAGO, Feb. 13—Decision to broaden the scope of its "Care Will Save Your Car" campaign by going into the idea on a national advertising scale featured the latest meeting of the Motor and Equipment Association board of directors in Chicago.

The plan calls for a complete campaign addressed to the public principally, but to the trade as well, emphasizing the value of preventive maintenance and periodic inspection. It will involve a cooperative tie-up between manufacturers, wholesalers, and dealers, all concentrating on educating the automobile driving public on the extreme extravagance of driving cars that are improperly serviced.

The plan was submitted to the board of directors after months of study by the Association's sales development committee and every precaution will be taken to keep all of the activities on a dignified though energetic basis. Erwin, Wasey & Company have been retained as advertising counsel to assist in directing the Association's message.

Moon Lists New Shares

NEW YORK, Feb. 13—The Moon Motor Car Co., St. Louis, has received permission to list 250,000 additional shares of no par value common stock on the New York Stock Exchange, it was announced here today. The additional shares are understood to provide for the purchase of rights in the Ruxton automobile, owned by the New Era Motors, Inc., New York, and for financing of new operations by the Moon Motor Car Co. With the additional shares listed, the Moon company now has 350,000 shares on the Exchange.

United Motors to Market Radio

DETROIT, Feb. 12—The entire sales and service of the new Delco automotive radio manufactured by General Motors is to be handled by the National organization of United Motors Service, Inc., according to an announcement at Detroit, by Ralph S. Lane, president and general manager of United Motors.

Automotive Steel Demand Picks Up on Firm Prices

**Backlogs Are Large and Quotation
Cutting is Rare**

NEW YORK, Feb. 13—Automotive buying of finished steel descriptions broadened further this week. Demand for such typically automotive kinds of steel as cold-rolled strip and cold-finished bars is 25 to 33 1/3 per cent greater than it was a month ago. There is room for much more improvement than has so far been recorded, but the rate of progress appears to have been somewhat accelerated in February.

In the sheet market, better demand is reflected in the gradual disappearance of much of the price-cutting that was in evidence in January. Whereas last month concessions of \$1 to \$2 per ton were the rule rather than the exception, an order now has to be unusually attractive to bring out quotations below the current market quotations. Some black sheet business offered at 2.60 cts., Pittsburgh, has been turned down. Full-finished automobile sheets are firm at 3.90 cts., Pittsburgh. Blue annealed, 10 gage, is held at 2.10 cts., Pittsburgh, and 13 gage at 2.25 cts. The leading interest announced on Monday an increase in unfilled obligations of 51,517 tons.

Whereas the unfilled tonnage increases in January and December were attributed to large annual rail contracts, the latest increase was undoubtedly due to better demand from industrial consumers. The backlog is the highest since February, 1926, and is the equivalent of more than four months' production at 75 per cent of capacity. While there is considerable disparity between some lines of finished steel and others, both the larger as well as most of the smaller "independents" are thought to have improved their position to about the same extent as the leading interest, making due allowance, of course, for the fact that in many descriptions of finished steel backlogs have entirely gone out of fashion.

Pig Iron—While demand from automotive foundries is far from spectacular, a consistent volume of buying for nearby shipment, much of it in single car lots, is reported. Competition between furnaces in different districts for business in the Detroit and Cleveland area is keen, but on the whole prices are well maintained.

Aluminum—Slowly rising demand for foundry metal is noted. Consumers' stocks are low. The market is entirely unchanged.

Copper—Producers appear to have strengthened their position and in view of sharply curtailed production are able to hold the price at 18 cts. Decline in output is generally estimated at 40 per cent. Manufacturers of automotive brasses are moderately busy.

Tin—With announcement that the Patino interests, which control Bolivian production, have acquired control of three out of four of the world's large smelters, more orderly conditions in the tin industry, which mean higher prices to consumers, are brought much nearer. The Straits market is still in the doldrums with spot

metal selling at around 39 cts., but this state of affairs is liable to change over night.

Lead—The Middle West market is easier while here it is unchanged.

Zinc—Quiet and steady.

Loomis Addresses Truck Men

WILMINGTON, DEL., Feb. 11—Edward F. Loomis, secretary of the Motor Truck Committee of the National Automobile Chamber of Commerce, spoke this evening before the Motor Truck Division of the Wilmington Chamber of Commerce on the place of trucks and buses as complements to railroad transportation.

Mr. Loomis quoted Chairman McManamy of the Interstate Commerce Commission, who stated at a recent hearing before the House Committee on Appropriations, that trucks and buses assisted railroads so far as net return was concerned. Mr. Loomis affirmed that the motor truck in a specialized field can perform certain types of transportation more economically and relieve the railroad of a burden.

Studebaker to Mark Company's Birthday

SOUTH BEND, Feb. 15—Studebaker tomorrow celebrates its 78th anniversary. During the first 68 years of its history Studebaker's total sales amounted to \$560,833,172. During the decade which ended December 31, 1929, total sales amounted to \$1,336,000,000. In the past 78 years, the modest capital of \$68 has grown to actual net assets of \$100,000,000. Twenty-one thousand men and women are employed in the Studebaker plants.

Hayes Adding to Canadian Plant

CHATHAM, ONT., Feb. 10—Hayes Wheels & Forgings, Ltd., are completing a large addition to their factory to be used in the manufacture of metal stampings, propeller shafts, universal joints, clutches, and axle housings. The building is of brick and steel fireproof construction, 120 ft. by 400 ft., and will greatly increase the plant's capacity. About 100 new employees will be needed when it is completed.

Reliance Specialty Adding

HOLYOKE, MASS., Feb. 10—Reliance Specialty Co. will occupy a larger plant for manufacture of its "Sleet Chaser" for automobile windshields. This device makes use of a current of heat generated by a plug-in connection with the generator and battery.

McKinley is Promoted

FLINT, MICH., Feb. 12—C. W. McKinley has been appointed assistant chief engineer of the experimental engineering department of the AC Spark Plug Co., according to an announcement.

Associated Alloy Steel Formed by Three Mills

**Timken, Sharon and Ludlum To
Participate**

NEW YORK, Feb. 11—The formation of a new steel company, Associated Alloy Steel Co., Inc., was announced today jointly by M. T. Lothrop, president, the Timken Roller Bearing Company; Severn P. Ker, president, the Sharon Steel Hoop Company, and H. G. Batcheller, vice-president, Ludlum Steel Company. The company has been incorporated to sell exclusively corrosion, heat and wear-resisting alloy steels produced by the Timken, Sharon and Ludlum companies.

The board of directors includes: H. G. Batcheller, vice-president, Ludlum Steel Company; J. Reid Evans, secretary and treasurer, the Sharon Steel Hoop Company; Severn P. Ker, president, the Sharon Steel Hoop Company; M. T. Lothrop, president, the Timken Roller Bearing Company; J. F. Sprough, secretary and treasurer, the Timken Roller Bearing Company; Neil F. Towner, attorney, Albany, New York.

The active management will be under the direction of David B. Carson, vice-president and treasurer, formerly sales manager, Development Division, Central Alloy Steel Corporation. Headquarters of the company will be located at Cleveland, Ohio and branch offices and warehouses established in strategic centers throughout the country. Mill facilities are being expanded and additional equipment for the most recent production practices is already installed.

January Production Drops

NEW YORK, Feb. 11—January production of motor vehicles in the United States and Canada has been estimated at 298,325 units, according to preliminary figures issued by the National Automobile Chamber of Commerce. This represents a decrease of about 32 1/2 per cent under production for January, 1928. A decrease of the same proportion for production during the current month as compared with the same month last year has been estimated by the Chamber.

Oakes Gets Large Order

CHICAGO, ILL., Feb. 4—The Oakes Products Co. this week put on full production as the result of landing an order for 500,000 tire locks from one of the largest automobile manufacturers. Officials of the company refused to reveal the name of the purchaser. The Oakes company is a division of the Houdaille-Hershey Corporation.

Rockford Business Gains

CHICAGO, Feb. 11—January business of the Rockford Drilling Machine Co., a subsidiary of Borg-Warner Corp., showed a substantial increase over January, 1929, according to C. S. Davis, president of Borg-Warner. Included in recent contracts is one for clutches from the American Austin Company.

Tire Man Sees Best Year on Basis of New Markets

Fleet Business, Airplane Needs,
Will Help, He Says

AUSTIN, TEXAS, Feb. 12—Joseph F. O'Shaughnessy of Detroit, assistant general manager of the United States Rubber Co., who has been investigating the trade situation in Texas in his 10,000-mile tour of the United States, expressed the belief that the present year will show the greatest volume of unit tire sales in the history of the industry.

"The tire demand will be felt in volume in the spring and become more pronounced as the season advances," Mr. O'Shaughnessy said. "Old cars held over for another year will also require new tires, which will further accelerate the normal demand."

"Fleets of commercial cars, trucks and taxicabs are increasing rapidly. The bus industry, which in eight years has become the country's largest medium of transportation, is increasing consumption. The airplane tire market, both in equipment and replacement, is expanding."

Golden Eagle to Move

COLUMBUS, OHIO—Announcement has been made by R. O. Bone, president of the Golden Eagle Aircraft Co., of Los Angeles, that the plant, including all manufacturing and sales activities of the corporation, would be moved to Columbus. The Golden Eagle is a popular-priced monoplane of the sport type. It will be manufactured at the rate of 10 per month for the first three months, after which the output will be increased. All equipment in the Los Angeles plant will be dismantled at once and shipped here. Employment will be given to about 100 men at the start.

Goodyear Moving Machinery

ST. HYACINTHE, QUE., Feb. 10—The Canadian National Railways are engaged in moving into St. Hyacinthe upwards of 160 carloads of machinery and other equipment for the enlarged mills of the Goodyear Cotton Co. of Can., Ltd. The machinery will be placed in the four-story addition which was recently built to the Goodyear mills. It is anticipated that the completed addition will be ready for operation early in April.

Koestlin Ready to Operate

DETROIT, Feb. 10—The Koestlin Tool and Die Corp. has moved its administrative offices into its new building which also houses the main part of its plant and is prepared to handle orders, particularly for large dies and tool equipment for producing automobile stampings, on a vastly increased scale, according to Herman F. Koestlin, president. The plant now has a total area of 42,000 sq. ft. with facilities for employing 450 men on a 24-hour basis.

Asks Special Stamps to Promote Touring

WASHINGTON, Feb. 12—Issuance of a series of postage stamps depicting the beauties and recreational assets of the national parks has been recommended to Federal authorities by the American Automobile Association, as a part of a comprehensive program for the promotion of travel in the Western States. The A.A.A. proposal has been made to Postmaster General Brown and has also aroused the interest of Dr. Ray Lyman Wilbur, Secretary of the Interior.

H. L. Callendar

PHILADELPHIA, Feb. 10—Professor H. L. Callendar, a noted British scientist, died toward the end of January at the age of 66. Professor Callendar, who occupied the chair of physics at the Imperial College of Science in London, was best known for his research work on the properties of steam. In 1927 Professor Callendar formulated a new theory of detonation in internal combustion engines, which he ascribed to the accumulation of peroxides in nuclear drops during rapid compression. These peroxides were shown to be very unstable, and it was suggested that they act as primer, causing simultaneous ignition of the drops. The theory was advanced that metallic dopes or anti-detonants act by reducing the peroxides as fast as they are formed.

Charles A. Ward

NEW YORK, Feb. 11—Charles A. Ward, one-time president of the Ward Motor Vehicle Co. but more recently chairman of the board of the Ward Baking Co., died at his home in New Rochelle yesterday at the age of 50 years. Mr. Ward took over the chairmanship of the baking company on the death of his brother a year ago. Surviving are his widow, his son, two brothers and five sisters.

Stevenson Joins Durant

DETROIT, Feb. 10—Harry A. Stevenson, well-known since the early days of the industry in Detroit automotive circles and for 10 years connected with Dodge Brothers, first in the traffic and sales divisions, and later as assistant successively to vice-presidents Arthur T. Waterfall and A. Z. Mitchell of that company, has joined Durant Motors as assistant manager of the factory branch recently opened in Detroit.

Thompson Production Gains

CLEVELAND, Feb. 12—Shipments totaling close to \$1,000,000 were made last month by Thompson Products, Inc., bringing January's production 60 per cent ahead of that of December, according to a statement by officials of the Thompson organization.

Marmon Advances Three; Sherer Made Director

Badger and Anderson Also Receive
New Appointments

INDIANAPOLIS, Feb. 10—The advancement of three Marmon officials to new executive positions, effective immediately, has been announced by G. M. Williams, president of the Marmon Motor Car Co., following a meeting of the company's board of directors.

C. J. Sherer, for the last five years Marmon treasurer, has been elected vice-president and director, and his former position is filled by the promotion of E. C. Badger from assistant treasurer, recently in charge of production operations. John W. Anderson, long identified with the Marmon manufacturing organization, is advanced to the position of general works manager.

Before coming to Marmon in 1924, Mr. Sherer was treasurer of the Dayton Wright Co., a division of the General Motors Corp., and earlier was treasurer simultaneously of the Dayton Metal Products Co., and the Dayton Wright Airplane Co. Concurrent with these positions, Mr. Sherer, in addition, controlled the financial operation of a number of other important manufacturing and financial companies.

Mr. Badger joined Marmon in 1919, after having served with various important concerns in accounting and auditing capacities. In 1921 he became comptroller of the Marmon company, and four years later he was elected assistant treasurer.

Mr. Anderson became associated with Marmon in 1918, and for some time has held the post of general factory superintendent. Many of the production methods in the Marmon factory were specially designed by him.

Ainsworth Net Gains

CHICAGO, Feb. 12—The annual report of the Ainsworth Mfg. Corp. for the year ended Dec. 3, 1929, shows net profit after all charges including reserve federal taxes of \$1,040,129, equivalent to \$6.47 per share on 160,665 shares of common stock outstanding at the end of the year. This compares with a net profit of \$663,573 or \$4.13 a share on the same number of shares outstanding for year ended Dec. 31, 1928.

Cleary Joins Newspaper

PHILADELPHIA, Feb. 12—John Cleary, formerly editor of *Motor Age*, has been appointed sales promotion manager of the *Philadelphia Record*. Before joining the Chilton Class Journal organization, he had served as director of advertising and sales promotion for the Cadillac Motor Car Co., Detroit, and the Peerless Motor Car Corp., Cleveland. He has also been identified with the advertising programs of the Cities Service Company, New York, and the City of Miami, Florida.

Report of Cord Corp. Reviews Its First Year

Assets On Nov. 30 Placed At
\$28,869,560

CHICAGO, Feb. 13—The annual report of the Cord Corp., covering the financial condition of the corporation to Nov. 30, 1929, shows total assets of \$28,869,560, including investments in the stocks of affiliated companies to the amount of \$24,380,976, it has been reported.

In a statement to stockholders accompanying the report, E. L. Cord, president of the corporation, says:

"Most of the companies in which the Cord Corp. has its principal investments are entering 1930 with greater sales volumes than for the same period last year. The financial condition is strong. Further acquisitions now being contemplated will add additional strength to the company's position in the industry. For these reasons the future is viewed with exceptional optimism."

The balance sheet follows:

ASSETS	
Cash in banks and on hand.....	\$698,186
Call loans	600,000
U. S. Treas. notes and accrued interest	2,338,545
Accounts receivable	248,484
Notes receiv.—secured by chattel mortgages	191,448
Inventories at cost	116,683
Total current assets	\$4,193,346
Stocks of affiliated cos. at cost...	24,380,976
Prepayments and deferred charges	31,429
*Land, bldgs., equipment, furniture, etc.	263,808
Patents, good will, development	1
Total assets	\$28,869,560
LIABILITIES	
Accounts payable	\$54,246
Accrued general taxes	10,413
Federal income tax	33,501
Total current liabilities	\$98,160
Deferred income	23,571
Capital stock (2,260,000 shares \$5 par)	11,300,000
Paid in surplus	17,216,999
Earned surplus	230,830
Total liabilities	\$28,869,560

* After reserve for depreciation of \$4,314.

Change Name of Section

PHILADELPHIA, Feb. 13—At a meeting of the Pennsylvania Section, Society of Automotive Engineers, held here last night it was decided to change the name to Philadelphia Section, Society of Automotive Engineers, owing to the formation of a section in the Pittsburgh territory. Two papers were presented at the meeting. One by Frank B. Spruance, American Chemical Paint Co., discussed "Proper Preparation of Sheet Metal for Finishing"; and the second, by George F. Farnsworth, director of the Detroit laboratories of the Edward G. Budd Mfg. Co., "What We Use for Finishing Automobile Bodies and Why." Walter A. Graf, engineer of the foreign division of the Budd companies, presided.

Borg-Warner Units Get Parts Orders

CHICAGO, Feb. 14—Increased activity of agricultural implement manufacturers is reflected in the reports of three subsidiaries of the Borg-Warner Corp., C. S. Davis, president, said today.

The Wheeler-Schebler Carburetor Co., Indianapolis, reports receipt of orders for tractor carburetors totaling \$150,000 in the last 30 days. Indiana Rolling Mill Co., Newcastle, had the largest month's business in its history in January and reports an increase of 33 per cent in its working force.

The Galesburg Coulter Disc Co. reports a 10 per cent increase in sales of implement parts in January over the corresponding month of 1929, and a 33 per cent increase in tractor parts business.

Chrysler Earnings Drop

NEW YORK, Feb. 13—Earnings of the Chrysler Corp. for the year ended Dec. 31, 1929, were \$21,902,168 after all charges, it was reported today. After provisions for the current dividend, a surplus of \$8,566,404 appears. The regular quarterly dividend of 75 cents has been declared, payable March 31, to stockholders of record March 3. The 1929 earnings compare with \$30,991,795 for the 1928 period.

Martin Shares Underwritten

NEW YORK, Feb. 13—Underwriting of 100,000 shares of common stock of the Martin Motor Truck Corp., which was formed to manufacture a diminutive commercial vehicle, has been taken over by the Goldbrook Corp., according to reports from the Martin corporation. Erection of steel work on the latter's factory project at Waverly, N. Y., is expected to begin next week, according to the announcement. Excavation for the foundations has been going ahead on schedule.

Cab Operator to Buy Equipment

NEW YORK, Feb. 10—Yellow Cab Co. of Chicago, subsidiary of the Parmelee Transportation Co., will spend in excess of \$2,000,000 for new equipment to be placed in service early this spring, according to announcement made by H. E. Miller, president of the parent organization. Officers of the company recently were authorized to purchase 1000 new cabs to replace some of the equipment now in service.

Steindler to Produce Wiper

NEW YORK, Feb. 12—Production of an electric clear across windshield cleaner is being planned by L. L. Steindler, New York formerly president of Mot-Acs, Inc. It is stated that the windshield cleaner has been under development for five years and has had the approval of several factory executives. Production is expected to begin about June 1.

Death of Walter Alford Ended Brilliant Career

He Had Served as Controller of
Two Great Businesses

KENOSHA, WIS., Feb. 13—The death of Walter H. Alford, vice-president and controller of the Nash Motors Co., in Kenosha, Wis., Feb. 5, announced last week in *Automotive Industries*, brought to light many facts concerning his long and interesting career in the automotive industry.

After an industrial career in St. Louis Mr. Alford came to Detroit in 1912 and joined the General Motors Corp. as controller. He occupied this position for six years, until Charles W. Nash resigned as president of the corporation, after which he elected to join with Mr. Nash.

Formation of the Nash Motors Co., built up upon the former Thomas B. Jeffery Co., which Mr. Nash had purchased, found Mr. Alford in charge of the financial destiny of the enterprise, a function which he discharged so well that he has been credited with being responsible for much of the success and financial stability of the company.

In addition to his duties with Nash, Mr. Alford found time to launch a successful political career. He served as president of the Kenosha City Council, and was regarded as a power in Wisconsin politics. The news of his death brought messages of condolence from many persons of prominence in industrial and political life.

Trucks, Buses, Aid Railways

(Continued from page 243)

certainly as compared with past years they are not losing net revenue from the competition of the trucks and buses."

"They are taking some of it at a higher price than shippers are willing to pay the railroad, because they get it at the store-door or at the residence, and deliver it at the same place at the end of the journey, whereas there would be two intervening carriers if that were real traffic," said Mr. McManamy.

Answering a query by Chairman Edward H. Wason, Republican, of Connecticut, of the subcommittee, Mr. McManamy said that generally motor vehicles are not at present harmful competitors of the railroads. Moreover, it was stated that many of the bus and truck lines are operated by railroads.

"What is the situation as respects passenger traffic?" asked Representative Clifton A. Woodrum, Democrat, of Virginia.

"They have cut into the passenger traffic more heavily than they have into the freight traffic, so far as we know," replied the commissioner. "But again we find that the short-haul traffic is less profitable and the general contention of the railroads is that passenger traffic does not yield a net return. That may not be true in all cases, but generally I think probably they are right."

Car Radios Offer Great Field, Meeting is Told

Michael Ert, Head of Associations, Presents This View

CLEVELAND, Feb. 13—A great rolling field of opportunity lies untouched and ready for the harvest at the door of the radio industry, Michael Ert of Milwaukee, president of the National Federation of Radio Associations, told radio convention delegates here on Monday.

He predicted that radios will be stock equipment on automobiles, like bumpers and headlights.

"Radios kill the monotony of long summer tours," he said. "They create entertainment and no hazard. They shorten the distance from city to city."

He told the delegates that last summer he had installed radios on eleven different makes of automobiles and that every one had proved successful. Five radio manufacturers are making instruments for auto installation, he said, and motor car makers are beginning to put aereals in bodies.

Franklin Deliveries Gain

SYRACUSE, Feb. 13—More Franklin cars were delivered at retail by dealers during the month of January, 1930, than during the corresponding month last year and the gain over 1929 figures has been maintained to date in the current month, H. H. Franklin, president, stated.

Orders from customers to the present week of the current month are 35 per cent ahead of orders received during a similar period in January, he said. Retail orders on dealers' books for later delivery are 26 per cent ahead of the figure reported one month ago.

Allied Products' Position

CHICAGO, Feb. 12—Preliminary figures of Allied Products Corp. indicate earnings of \$800,000 for the year ending Dec. 31, 1929, after all charges, including depreciation, taxes, etc. This is equal to \$16 per share on the Class "A" convertible stock outstanding. After payment of the \$3.50 per share preferential dividend on the Class "A" stock, the balance remaining was equal to \$8.33 per share on the 75,000 shares of common stock outstanding. On this latter a dividend of 50 cents per share was paid on Jan. 1. The above earnings were at the rate of \$6.40 a share on the combined Class "A" and common stock. Current position shows assets of \$1,850,000 compared with current liabilities of \$288,000 which included Federal taxes and dividends due Jan. 1. Cash and government securities totaled \$828,000.

G.M. Truck Adding Models

DETROIT, Feb. 12—According to statements by Paul W. Seiler, president, and O. L. Arnold, vice-president, of General Motors Truck Co., several basis models will be added shortly to give the G.M.C. line complete coverage of the entire truck field.

Financial Notes

Hayes Body Corp. reports net loss after all charges for 1929 of \$245,045. This compares with profit of \$884,529, or \$3.35 a share, for 1928.

Miller Rubber Co. reports net loss for the year 1929 after all charges of \$1,864,610 as compared with \$3,434,901 in 1928.

Mohawk Rubber Co. of Ohio and the Mohawk Rubber Co. of New York, Inc., reports net income for the year 1929 after all charges of \$216,327. This is equivalent, after preferred dividends, to 56 cents a share on common stock and compares with income of \$687,910, or \$4.73 a share, on outstanding stock in 1928.

Goodyear Tire and Rubber Co. reports net profit for 1929 of \$18,614,374 after all charges. This is equivalent after preferred dividends to \$9.34 a share on common stock. Regular quarterly dividend of \$1.25 on common, payable May 1 to stockholders of record April 1, and \$1.75 on preferred, payable April 1 to stockholders of record March 1, has been declared.

Electric Storage Battery Co. has reconsidered its proposed plans for increasing the number of shares of capital stock, and now recommends that no change be made in capital stock at this time. Notice of suggested change was mailed to stockholders on October 17. This proposal will not now be submitted to the stockholders' meeting when that convenes.

Timken Roller Bearing Co. has declared regular quarterly dividend of 75 cents payable March 5 to stockholders of record Feb. 18.

Caterpillar Tractor Co. has declared regular quarterly dividend of 75 cents on common and an extra dividend of 25 cents payable March 15 to stockholders of record Feb. 15.

B. F. Goodrich Co. has declared regular quarterly dividend of \$1 on common and \$1.75 on preferred, both payable July 1 to stockholders of record June 14.

Houdaille-Hershey Corp. has declared regular quarterly dividend of 62½ cents on Class A and 50 cents on Class B stock, both payable April 1 to stockholders of record March 20.

Western Auto Supply Co. has declared regular quarterly dividend of 75 cents on Class A and Class B stocks, respectively, payable March 1 to stockholders of record Feb. 18.

Triplex Safety Glass Co. of North America reports net sales for 1929 of \$4,668,000 as compared with \$1,986,590 for 1928, according to A. L. Haskell. The ratio of current assets to current liabilities at the end

of 1929 was 27 to 1 as compared with 3 to 1 at the end of 1928.

General Tire & Rubber Co. reports net profit for the year ended Nov. 30, 1929, of \$1,970,000 after all charges. This is equivalent to \$21.16 a share on common stock and compares with \$2,002,000, or \$21.80 a share, for the fiscal year ended Nov. 30, 1928.

Pines Winterfront Co. has declared regular quarterly dividend of 25 cents and a quarterly stock dividend of two per cent, both payable March 1 to stockholders of record Feb. 15.

Vacuum Oil Co. has declared regular quarterly dividend of \$1 payable March 20 to stockholders of record Feb. 28.

Muncie Gear Co. reports net profit for 1929, after all charges, of \$3,878, as compared with \$228,506 in 1928.

Winton Engine Company directors have declared the regular quarterly dividend of 75 cents a share on the preferred stock and \$1 on the common stock, payable March 1 to stockholders of record Feb. 20.

Commercial Credit Company and subsidiaries for the year ended Dec. 31, 1929, showed net operating income of \$6,254,142, after provision for bonuses, Federal taxes and reserves. This is equivalent, after deducting small minority interest and all preferred dividends, to \$4.48 a share on 1,003,684 average no par common shares outstanding during the year, and \$4.33 a share on 1,037,052 shares outstanding at the end of the year.

Motor Wheel Corp. has declared a cash dividend of 75 cents a common share to be paid March 10 to stockholders of record Feb. 20.

White Motor Co. will show net profit for 1929 of \$2,875,000, or \$3.59 a share on outstanding stock, according to preliminary financial statement. This compares with net profit for 1928 of \$2,320,813. Regular quarterly dividend of 50 cents a share, payable March 31 to stockholders of record March 12, has been declared.

Federal Mogul Corp. reports a net income for 1929 of \$305,764 after all charges including Federal taxes. This is equal to \$2.35 per share of common stock. The balance sheet as at Dec. 31, 1929, shows net working capital of \$567,156 with current assets 2½ times current liabilities.

Motor Bankers Corp. reports earnings of \$308,957 or \$2.99 a share on 149,713 shares of common stock outstanding for 12 months ended Dec. 31, 1929. This compares with \$218,753 for the corresponding period in 1928.

United Motors Appoints Smith

DETROIT, Feb. 12—H. C. Smith has been appointed advertising manager of United Motors Service, Inc., as successor to T. S. P. Griffin, who has received an indefinite leave of absence on account of ill health. For the past three years, Mr. Smith has been employed on the Pacific coast as manager of the San Francisco and Oakland branches of United Motors Service.

St. Louis Attendance Gains

ST. LOUIS, Feb. 10—The St. Louis Automobile Show closed Saturday after breaking attendance records every day and presenting the most comprehensive array of exhibits in the 23 years of its history.

The total attendance for the six-day show was 137,376, exceeding by 12,372 the mark set in 1928, the best previous showing.

Aero Chamber Completes St. Louis Show Program

Engineering and Education Are
Chief Activities

NEW YORK, Feb. 10—The Aeronautical Chamber of Commerce of America has announced its schedule of meetings and sessions to be held in conjunction with the International Aircraft Exposition in St. Louis Feb. 15 to 23.

There will be sessions, meetings and luncheons given by many local civic organizations, and each day of the show has been designated as a representative day for such organizations as the American Legion, St. Louis Chamber of Commerce, St. Louis Industrial Club, St. Louis Advertising Club, Rotary, Kiwanis, Lions and Optimists organizations.

The National Conferences on Aeronautical Education under the auspices of the Chamber, in cooperation with The Daniel Guggenheim Fund Committee of Elementary and Secondary Aeronautical Education, will be held at the Statler Feb. 17 to 19. Among the speakers at this conference are Roland H. Spaulding, chairman of the Educational Committee of the Chamber; Dr. John W. Withers, chairman of The Daniel Guggenheim Fund Committee on Education; Prof. Earl W. Hill of the University of Southern California; Andrew D. Althouse, Cass Technical School; J. S. Marriott, Chief of Inspection Service of the U. S. Department of Commerce; Charles S. Jones, president of Curtiss-Wright Flying Service; Edward P. Warner, former Assistant Secretary of the Navy for Aviation; Willis B. Haveland, Universal Aviation Corp.; H. F. Lusk, dean of the Boeing School of Aeronautics, Bradley Jones, head of the Department of Aeronautics, University of Cincinnati, and B. G. Shackelford, assistant superintendent of schools of St. Louis.

There is to be a three-day session of the Society of Automotive Engineers at the Hotel Jefferson, which will discuss engine, fuel and instrument production and development. Included in the S.A.E. program will be a joint meeting with the Aeronautical Chamber of Commerce and another joint meeting with the National Airway Marking Association.

Purchases Altoona Speedway

ALTOONA, PA., Feb. 10—The Altoona Racing Association is the new organization which has become owner of the Altoona Speedway, purchasing the speedway property at sheriff's sale recently. The speedway is located on a plot of 111 acres at Tipton and was erected in 1923 by the Altoona Speedway Association, which continued its operation until the recent sale.

Soviet Tractor Imports

NEW YORK, Feb. 10—Amtorg Trading Corp. is shipping to the Soviet Union for its spring plowing campaign 20,125 tractors valued at \$30,000,000.

Brown Takes Lead, Color Index Shows

NEW YORK, Feb. 12—Brown has gained leadership by a wide margin over all other automobile color families, for the first time on record, according to the February issue of the Automobile Color Index, published by the Duco Color Advisory Service. Blue is at the lowest ebb in 17 months, while green is still following the sharp upward trend commenced last November, the Index says. There is little demand for grey and black, and the general tendency is toward closely blended shades, in multiple combinations.

Aero Chamber Backs Bill

NEW YORK, Feb. 10—The Aeronautical Chamber of Commerce of America, Inc., has communicated with the Senate and House of Representatives' committees on postoffices and post roads urging favorable action on the bill providing for a readjustment of the present contract air mail system. This communication was sent out in the form of a telegram signed by Frederick B. Rentschler, president of the Chamber.

John Beltz

DETROIT, Feb. 10—John Beltz, age 58 years, for the past 10 years factory superintendent of the wheel division of the Motor Wheel Corp., Lansing, Mich., died suddenly at his home Feb. 5. He had been an employee of the company for 17 years. Born in Germany, Mr. Beltz came to this country at the age of 12 years and spent the remainder of his life as a resident of Lansing.

Standard Oil Enters Ceylon

COLOMBO, CEYLON, Jan. 6—The Standard Oil Co. of New York, which has been doing extensive business in Ceylon for some years in liquid fuel, is reported to be making arrangements to enter the petrol market during the early part of this year. The installation of storage facilities providing for a capacity of nearly 1,500,000 gal. for the company, is being proceeded with at the Kollonnawa Oil Installation while, to start with, petrol depots are also being erected in several centres in Colombo.

Chrysler Raises Marine Output

DETROIT, Feb. 10—Sales of the new Chrysler Straight Eight, 150 hp. "Majestic" marine engine, the latest to be added to the Chrysler marine engine line, have exceeded all expectations for the first quarter of this year, according to H. E. Fromm, sales director of the marine engine division of Chrysler Corporation. Enough orders have been received to warrant the increase in February and March production to more than twice the estimated production for this period.

Borg-Warner to Expand Replacement Parts Sales

Plans Warehousing Facilities and
More Output

CHICAGO, Feb. 10—Entrance of the Borg-Warner Corp. into the replacement parts business, on a nation-wide scale, involving the formation of a new subsidiary company, the taking over of five long-established parts warehouses and the extension of replacement parts manufacture to all its automotive units, was announced today by C. S. Davis, president of Borg-Warner Corp.

A new subsidiary, known as the Borg-Warner Service Parts Co., has been formed to provide regional warehouses for all replacement parts manufactured by the Borg-Warner units. To accomplish this, the Borg-Warner Service Parts Co. has taken over the five warehouses which formerly acted as exclusive distributors of the Warner Gear Co., one of the component units of the Borg-Warner organization. These five warehouses are located at the following distributing points: New York City; Chicago; Atlanta, Georgia; Dallas, Texas, and Oakland, Cal.

Automobile Fatalities Rise

NEW YORK, Feb. 10—Automobile fatalities during 1929 showed an increase of 12 per cent among the 19,000,000 industrial policy holders of the Metropolitan Life Insurance Co., according to announcement of the company made here recently. On this basis the company estimates that 31,400 deaths were attributable during the year to automobiles throughout the country.

Aluminum Industries to Add

CINCINNATI, Feb. 10—Expansion plans designed to increase plant capacity have been completed by officials of Aluminum Industries, Inc., and contracts let for two new buildings for increased production in the permanent mold foundry and the machine shop. The buildings, which will be of saw tooth construction, will cost approximately \$100,000 and will add 30,000 sq. ft. of floor space at the Beekman Street factory.

Auburn Sales Increase

AUBURN, IND., Feb. 10—Auburn Automobile Company's January sales were 40 per cent greater than for the corresponding month last year, R. H. Faulkner, vice-president, said today. The sales of both Auburn and Cord cars in February are continuing to mount and a new high record may be set for the month.

G. M. Japan Resumes

NEW YORK, Feb. 10—General Motors Japan, Ltd., has opened its Osaka plant after a shutdown due in part to labor disturbances, according to reports from Japan which have been confirmed by officials of General Motors Export Co. The plant was reopened with full normal complement of 1200 workmen.

General Motors Plans New Securities Group

Younger Executives to Participate
in Latest Project

NEW YORK, Feb. 11—General Motors Corp. at its directors' meeting last week authorized the calling of a special stockholders' meeting for March 5 to pass on a plan for the formation of General Motors Management Corp. This new corporation is to take the place of the Managers Securities Co., organized in 1923 for the purpose of aiding men who occupy key positions in the company in the purchase of the company's stock.

The Managers Securities Co. was to have expired Dec. 31 of this year and the proposed new company is designed to take its place in performing the same function for the younger group of General Motors executives who have come up since the organization of the original company.

The present plan is that General Motors Management Corp. shall operate during the current year and the existing Managers Securities Co. will then cease functioning.

Forms Operating Subsidiary

NEW YORK, Feb. 10—The Aviation Corp. has formed a subsidiary, American Airways, Inc., to handle all its transportation activities. James T. Hamilton, former president of New York State Railways, is president of the new company, according to announcement made by Graham B. Grosvenor, president of the Aviation Corp. The organization has been effected by an exchange of stock within the corporation.

Helmer to Enter Canada

HULL, P. Q., Feb. 10—According to a recent announcement by A. Laferriere, industrial commissioner of Hull, P. Q., the Helmer Hydraulic Jack Co., Sherman, N. Y., will shortly establish a branch plant in Hull for the manufacture of automobile accessories. R. W. Helmer, president of the company, has purchased property formerly owned by the Hull Knitting Co. and alterations to the building are under way. The industry is expected to employ about 100 men when in full operation.

Issues Battery Specifications

NEW YORK, Feb. 11—The National Battery Manufacturers Association has issued a standard battery specifications bulletin showing the batteries used in various makes of cars, designated according to their specifications by numbers arbitrarily set by the association.

Bendix Brake Shipments Up

CHICAGO, Feb. 10—Bendix Brake Co., a division of Bendix Aviation Corp., today announced that shipments in January to automobile manufacturers will be more than 25 per cent greater than January of last year.

Studebaker Plant is Host to Many

SOUTH BEND, Feb. 11—Proof of the interest displayed by the general public in a modern automobile factory is amply afforded by the large number of visitors to the Studebaker manufacturing plants. During 1929 there were nearly 28,000 factory visitors, representing 22 foreign countries. Visitors from the United States totaled 27,799. Of these, Indiana, Studebaker's home state, and Illinois contributed by far the largest number with 19,654 and 4113 respectively.

Aviation Show Opens

NEW YORK, Feb. 10—The second aviation show, held by Aviators Post No. 743 of the American Legion, in Grand Central Palace, opened last Saturday with a good attendance. This is primarily a local show, most of the exhibitors in the aircraft field being local distributors and dealers.

There are 29 different makes of planes on exhibition, five different makes of motors and two gliders, a number of accessory exhibitors in addition to toy exhibitors and others catering more or less directly to the public interest in aviation. The show extends throughout the week.

Plans Airplane Factory

VANCOUVER, WASH., Feb. 10—The Martin Airport Corp. of Washington, which is affiliated with the Martin Airport Corp. of Oregon, of which E. W. Martin is president, announce the construction of a \$20,000 factory here. It will be used for the manufacture of 6-place cabin monoplanes, which will be used in the company's air taxi service throughout Oregon and Washington. Prior to the completion of the factory, plane construction will be carried on in the Interstate Electric Welding Co.

Illinois to Improve Roads

SPRINGFIELD, ILL., Feb. 13—Upwards of \$50,000,000 will be Illinois expenditures this year toward furnishing good roads. Of this \$9,929,471, to have been used last year but which was tied up by suits, will be released. In addition there will be approximately \$26,000,000 from the state's three cent gas tax and about \$18,000,000 from vehicle tax. This does not include county bond issues which will be spent on state-aid roads.

Reduce Stinson Directorate

WAYNE, MICH., Feb. 10—At the annual meeting of stockholders of the Stinson Aircraft Corp., last week, the directorate was reduced from 15 to 5 members. The board as now constituted has the following membership: E. L. Cord, chairman, Edward A. Stinson, W. A. Mara, Raymond S. Pruitt and L. B. Manning.

Johnson Cites Progress of South American Roads

Have Solved Problems in Light of
U. S. Practice, He Says

NEW YORK, Feb. 10—Speaking before the General Motors Export Club here last week, Pyke Johnson, Washington representative of the National Automobile Chamber of Commerce and executive secretary of the Second Pan American Highway Congress, stated that highway development is now well under way in South and Central America and will proceed more rapidly than it did in the United States in the early stages.

These countries have available methods of road building, solutions to the problems of finance, administration, construction and maintenance, which have been developed as the result of the experience in the United States and which give them a marked start in their development. Further, the use of the motor vehicle as an economic necessity is now so generally recognized that these countries will consider the importance of road building more readily than was true in the early experience in this country.

Rolls-Royce Moving Depot

SPRINGFIELD, MASS., Feb. 10—Rolls-Royce of America, Inc., is moving its maintenance depot from Waltham Ave., where it has occupied space in the same building where its coach works formerly were located, to its works in East Springfield. No official corroboration has been given to the report that operations in the American plant will thenceforth be confined to assembly and maintenance, but several steps indicate that such a change is being made.

Personals

Verville Appoints Goff

E. A. Goff, well-known as a pilot and airplane salesman, has been appointed sales director of the Verville Aircraft Co., according to an announcement by Alfred V. Verville, president.

In directing the distribution of Verville Aircraft Co., Mr. Goff's first efforts will be the establishment of dealers throughout the country.

Sirrinc Joins Autocar

H. M. Coale, vice-president in charge of sales of the Autocar Co., Ardmore, Pa., motor truck manufacturers, has announced the appointment of E. D. Sirrine to the position of transportation engineer on the Autocar headquarters staff.

Indian Elects Wilder

Laurence R. Wilder of Boston has been elected a director and chairman of the finance committee of the Indian Motorcycle Co., Springfield, Mass. Mr. Wilder is formerly of the Scintilla Magneto Co., recently merged with the Bendix Co.

Men of the Industry and What They Are Doing

G. M. Export Movements

Among the recent movements of General Motors Export Co.'s overseas personnel is the sailing last week of R. G. Clark, production superintendent of General Motors South African, who had been attending the foremen's training course of General Motors Institute of Technology at Detroit. H. Yamamoto, of General Motors Japan, who also was attending this course, sailed this week for Osaka.

Others departing during last week for their overseas posts were: S. Nakai, sales representative of General Motors Japan; G. J. Foley, of General Motors Australia; J. H. Rothardt, of the planning department of General Motors G. m. b. H., and F. R. Rhuberry, trim specialist of General Motors Argentina.

Louis Adams, paint specialist of General Motors Argentina, arrived last week from Buenos Aires, reporting to the home office for vacation and new assignment.

Marmon Appoints Rowe

The appointment of S. E. Rowe as assistant chief engineer of the Marmon Motor Car Co., Indianapolis, has been announced by Col. Howard Marmon, vice-president in charge of engineering. Mr. Rowe already has assumed his new duties at the Marmon factory.

For more than 22 years Mr. Rowe has been actively engaged in the automotive engineering field. Prior to his association with Marmon, Mr. Rowe was a member of the engineering staff of the Stutz Motor Car Co.

Smith Leaves Nash

E. L. Smith, assistant sales manager, has announced his resignation from The Nash Motors Co. "Mr. Smith's decision to sever his long and mutually valuable and pleasant associations with us in Kenosha is a matter of keen regret to me and to all who have known him through the years he has helped to build up the Nash factory sales organization," C. H. Bliss, sales manager, said in commenting on the announcement.

U. S. Rubber Elects Two

United States Rubber Co. has elected Charles H. Sabin, chairman of the board of the Guaranty Trust Co., of New York, and David Dwight Douglas, president of the First National Bank in Detroit, as members of its board of directors. Mr. Sabin was also elected a member of the finance committee.

Joins Porter Agency

E. W. Nelson, formerly with the Multibestos Co., Walpole, Mass., in charge of sales promotion and advertising to dealers, has joined the Porter Corp., advertising agency, Boston.

Made Division Chief



A. W. Childs

Who has been appointed chief of the Automotive Division, Bureau of Foreign and Domestic Commerce

WASHINGTON, Feb. 13—A. W. Childs, Conneaut, Ohio, assistant chief of the Automotive Division, Bureau of Foreign and Domestic Commerce, Department of Commerce, since April, 1928, has been promoted to the position of chief of the division, succeeding H. O. Smith, who resigned some time ago. Announcement of the appointment of Mr. Childs to head the Automotive Division was made by Director W. L. Cooper of the Bureau on Monday of the present week.

Mr. Childs, who is 32 years of age, has had a wide experience in foreign trade promotion work with particular reference to foreign sales of automotive products. For six years he served as American Vice Consul at various posts in South America during which time he studied and submitted many reports on the opportunities in those regions for expanding the sales of American automotive products.

In May, 1925, he resigned from the Consular Service to enter the employment of a large American automobile manufacturing concern as field representative to Latin America. After approximately one year's employment with this firm he was retained by a large American automobile corporation as traffic manager.

Pratt and Whitney Transfers

O. C. Christiansen, formerly assistant service manager of the Pratt and Whitney Aircraft Co., Hartford, Conn., has been transferred to the Pacific coast as western representative of the company, according to an announcement made by B. H. Gilpin, service manager. Mr. Christiansen is relieving E. B. Haines who will return to the Pratt and Whitney Aircraft Company's Hartford office immediately following the St. Louis Show. J. L. Bunce, also of the service department, Mr. Gilpin announced, will succeed Mr. Christiansen as assistant service manager at Hartford, and C. G. Runyon, formerly service department representative at Chicago, has been brought to the Hartford office to handle the work previously taken care of by Mr. Bunce. The transfers are effective immediately.

Coatalen Coming to U. S.

Louis Coatalen, managing director of the Sunbeam Motor Car Company, Ltd., of Wolverhampton, England, will be in New York in March in connection with the attempt on the world's speed record which is to be made with a Sunbeam racer at Daytona Beach. Mr. Coatalen, who is one of Europe's leading automobile engineers, has been working on solid-injection oil engines for the past several years and claims to have succeeded in developing an engine that will maintain constant torque up to 2000 r.p.m., the engine having a bore of about 4 3/4 and a stroke of about 6 1/4 in. The output of the engine is said to be 20 hp. per liter or very nearly 1 hp. per 3 cu. in. displacement at 2000 r.p.m.

Packer on Contest Board

The Contest Board of the American Automobile Association has appointed C. Edward Packer, of Williams and Cunningham advertising agency, formerly technical editor, *Automobile Trade Journal and Motor Age*, as a member of the National Technical Committee to represent the Chicago area, it has been announced.

Sheldon With Johnson Motor

J. H. Sheldon has been appointed advertising manager of the Johnson Motor Co., Waukegan, Ill., effective Feb. 3. C. E. Pugh has been appointed assistant advertising manager in charge of advertising production and office operation. Mr. Sheldon has been director of publicity.

Scott is Promoted

J. Y. Scott, assistant general manager of the Van Norman Machine Tool Co., Springfield, Mass., has been elected second vice-president and assistant treasurer of the company. He has been with the company 14 years.

Essex Wire Co. Formed to Operate Former Ford Plant

Increased Production is Planned by New Owner

DETROIT, Feb. 8.—The Essex Wire Corp., with a capitalization of \$1,000,000, has been formed by a group of Detroiters, to operate the wire manufacturing plant purchased from the Ford Motor Co. The company last week took over the portion of the Ford Highland Park plant devoted to this industry.

A. E. Holton, head of Holton and Co., bankers, in the Buhl Bldg., is president of the new concern, and H. A. Strickland, sales representative for a number of automotive products, with offices in the Fisher Bldg., is vice-president and general manager.

"This is a new organization of Detroit capitalists and is not connected in any way with the older wire companies," Mr. Holton said. "We are not employing any additional men at this time, but when the plant is operating at full capacity in the near future, we expect to employ a total of about 1000 men. The company will increase its output in expanding its field to include all automobile companies, where the plant formerly supplied the Ford factory alone.

"We have purchased the entire equipment of the wire plant of the Ford Highland Park factory, and have taken a long-term lease on that portion of the factory. All men were reemployed Saturday, when we took over the unit. There will be readjustments regarding wages and work." The plant will manufacture automobile ignition wire, wire assemblies, battery cables, bare copper wire and magnet wire for automobiles.

Under the Ford company, the plant employed from 500 to 600 workers.

To Test Six Wheeler

OTTAWA, ONT., Feb. 10.—Tests will be made with a rigid six-wheel truck developed by the British War Office by the Department of National Defense which may mean much to the development of the northlands of Canada. It is claimed to have the climbing ability of a tank and the speed of an ordinary four-wheel truck.

N. J. Changes Commissioners

NEW YORK, Feb. 10.—Representative Harold G. Hoffman, Republican, of South Amboy, N. J., has been elected State Commissioner of Motor Vehicles for New Jersey, to succeed William L. Dill, whose term expires April 1. Mr. Dill has held the position for 15 years, it being guaranteed to him by the existing law of the state until this year.

Federal Reports Increase

DETROIT, Feb. 11.—The Federal Motor Truck Co. reports an increase for Jan., 1930, of 33 per cent over the same period last year.

Four Car Makers On Big Earnings List

NEW YORK, Feb. 10.—Four automobile manufacturers are represented among the 39 industrial companies in the United States who distributed more than \$10,000,000 in dividends during 1929, according to a report prepared by the Boston News Bureau and published in the Wall Street Journal.

They were: General Motors, Packard, Nash and Chrysler.

Crude Rubber Active

NEW YORK, Feb. 10.—Further endeavors to restrict the output of crude rubber were reported last week, according to F. R. Henderson Corp. A number of Shanghai rubber companies have fallen in line with several of the British companies operating in the Malay States in agreeing to curtail the 1930 production by 10 per cent.

Trading on the New York Rubber Exchange was slightly more active than earlier in the year, with a fairly steady demand for off grades. Singapore has been a reluctant seller at current prices. As a result there is a firmer feeling in the market than has prevailed for some time.

Stocks of crude rubber in London have increased to 60,460 tons, with Liverpool stocks decreased to 19,898 tons.

Bendix Buys Bragg

NEW YORK, Feb. 10.—Bendix Aviation Corp. has purchased the Bragg-Kliesrath Corp. of Long Island City, makers of vacuum brake boosters, according to announcement made here this week end by Vincent Bendix, president of the aviation company. Manufacture, sales and service of Bragg-Kliesrath will be continued at Long Island City with the present personnel, according to Mr. Bendix. Large production orders will be manufactured at the Bendix brake plant at South Bend, Ind.

Consolidated Plants in Canada

TORONTO, ONT., Feb. 10.—Manufacture of aeroplanes on a large scale in Ontario is forecast with the announcement of the Consolidated Aircraft Corp., of Buffalo, N. Y., that their plant will be in operation at Fort Erie before spring, producing light "Fleet" training machines. The plan of the Consolidated organization not only provides for sale to the Canadian market, but also to Europe.

Plans Office-Garage Building

SPRINGFIELD, MASS., Feb. 11.—Gibraltar Garage & Office Bldg., Inc., has projected a structure of eight stories and basement, the first five floors and basement of which are designed to be used as a parking garage housing 1000 cars. The upper floors will be used for office purposes.

Business in Brief

Written by the Guaranty Trust Co., New York, exclusively for AUTOMOTIVE INDUSTRIES.

NEW YORK, Feb. 13.—Unfavorable weather last week continued to influence both wholesale and retail trade adversely. Industrial activity, however, made a better showing. Production of and demand for iron and steel increased. Curtailment continued in the textile industries.

CHAIN STORE SALES

Sales of 23 store chains during January amounted to \$101,432,898, which marks an increase of \$6,189,213, or 6.49 per cent, above those a year ago.

COMMERCIAL FAILURES

Commercial failures during January, as reported by R. G. Dun & Co., totaled 2759, as against 2037 during the preceding month and 2535 a year ago. Liabilities involved in January failures amounted to \$61,185,171, as against \$67,465,114 in the preceding month and \$53,877,145 a year ago.

FARM PRICE INDEX

The index of the general level of farm prices on Jan. 15 stood at 134, based on the pre-war level as 100, as compared with 135 a month earlier and 133 a year ago.

FREIGHT CAR LOADINGS

Railway freight loadings for the week ended Jan. 25 totaled 862,621 cars, which marks a decrease of 63,853 cars below those a year ago and a decrease of 40,043 cars below those two years ago.

FISHER'S INDEX

Professor Fisher's index of wholesale prices for the week ended Feb. 8 stood at 93.4, as against 93.3 the week before and 93.7 two weeks before.

BANK DEBITS

Bank debits to individual accounts outside of New York City for the week ended Feb. 5 were 12 per cent below those in the corresponding week last year.

BROKERS' LOANS

Brokers' loans in New York City during the week ended Feb. 5 increased \$57,000,000, bringing the total up to \$3,402,000,000.

FEDERAL RESERVE STATEMENT

The consolidated statement of the Federal Reserve banks for the week ended Feb. 5 showed a decrease of \$25,500,000 in holdings of discounted bills. There were increases of \$37,300,000 in holdings of bills bought in the open market, of \$1,300,000 in holdings of Government securities, and of \$30,900,000 in member bank reserve deposits. The reserve ratio on Feb. 5 was 78.0 per cent, as against 78.3 per cent a week earlier and 76.3 per cent two weeks earlier. During last week the Federal Reserve banks of New York and Chicago reduced their rediscount rates from 4½ to 4 per cent.

Ford Files Disclaimer on Canadian Tariff Rule

W. R. Campbell, President, Dominion Company, Testifies

OTTAWA, ONT., Feb. 10—An eleventh-hour disclaimer by the Ford Motor Car Co. of Canada to the effect that this corporation did not associate itself with some of the presentations made by the other automobile manufacturers of Canada featured a recent session of the Tariff Advisory Board. The hearing upon automobiles had closed with the lunch hour adjournment, but late in the afternoon, W. A. Campbell, president of the Ford Company made a supplementary statement in reply to questions which had been asked previously.

In respect of the Ford proposal that the customs duty be levied on the list price of cars in the country of export, Mr. Campbell pointed out that this practice was in force in some countries, and he named Salvador, Jugo-Slavia and Roumania. In support of the company's contention that it was inconsistent that the duty on component parts should be higher than that on the completed automobile, he stated that in France, Great Britain, the United States and Germany, the component parts carried a lower rate of duty than that which is placed upon the completed article.

Stinson Near Capacity

DETROIT, Feb. 11—Production of Stinson Aircraft Corporation is rapidly approaching capacity with a schedule of 300 airplanes during the first four months of 1930, William A. Mara, vice-president, announced here today. Ten planes a week are being produced at the Wayne, Michigan, plant where 150 workmen now are employed.

Irving to Build in Canada

BUFFALO, Feb. 10—George Waite, president of the Irving Air Chute Co., Inc., Buffalo, states that ground has been broken at Bridgeburg, Ont., Canada, for the construction of a Canadian plant for his company. It is expected that the plant will be in operation by early summer.

St. Louis to Have Port for Gliders

DETROIT, Feb. 10—Frank M. Blunk, special sales representative of the Detroit Aircraft Corp., has reported that Harry Kuchins, a furniture manufacturer of St. Louis, who has for the past two years been a glider fan in St. Louis, has leased a tract of land near Creve Cour Lake in St. Louis for the building of the first exclusive glider airport in the United States. This tract is a natural amphitheatre and gliders may be flown at all times, regardless of wind direction, as the gliderport includes hills approximately 100 feet high surrounding the entire tract.

Plane Skis Pass Test

DETROIT, Feb. 8—The Department of Commerce has accepted three types of skis manufactured by the Aircraft Products Corp., 7424 Melville Ave., Detroit, according to an announcement by the company. While the department has not yet established a standard for an approved type certificate for skis, it has agreed that these skis are of sufficient strength and proper design for approval. The B type is for planes under 2600 lb., the J for planes weighing less than 3200 lb. and the S type for planes weighing up to 4500 lb. A ski for trimotor planes is near completion. All these skis are equipped with Oildraulic shock absorbers, which take the place of the resiliency of the inflated airplane tire. They are in use on Lockheed, Stinson and Pitcairn planes.

Gardner Reports Condition

ST. LOUIS, Feb. 10—The preliminary report for the year 1929 of the Gardner Motor Co., Inc., indicates cash on hand of over \$300,000 as against total current liabilities of less than \$50,000, a ratio of cash against current liabilities of better than 6 to 1. It is understood that stocks of any cars on hand unsold in the fields are lower than at any similar period in the company's history.

Noblitt-Sparks Made Record Profit in 1929

Sales Also Exceeded Other Years
Annual Report Says

CHICAGO, Feb. 11—Sales and net profits of Noblitt-Sparks Industries, Inc., for the year ended Dec. 31, 1929, reached the highest totals on record, the annual report for the year, released today, reveals. Net income after all charges and taxes amounted to \$675,700 as against \$294,604 for 1928.

Last year's net is equivalent to \$9 a share on 75,000 shares of common stock outstanding while 1928 net equalled \$4.91 a share on 60,000 shares then outstanding. Gross sales last year amounted to \$5,362,158 compared with \$2,901,371 in the preceding year, an increase of 85 per cent. Profit and loss surplus on Jan. 1, 1930, totaled \$649,931 against \$269,306 at the start of 1929.

Each division of the corporation showed a substantial improvement during the year, Q. G. Noblitt, president, says in his remarks to the stockholders. "The most sensational gain was in our Arvin Heater division where the volume was slightly over three times greater than in 1928," he said. "With more diversified products and a broader and more firmly established market for such products, I am optimistic over our prospects for 1930."

Hudson January Shipments

DETROIT, Feb. 10—Hudson Motor Car Co. has announced January shipments of 18,948 Hudson and Essex cars. This is a marked pick-up in activity from the closing months of 1929, and, though below the record of January a year ago, is in line with the shipping schedule which the company laid out for itself the first of the year.

Miller Holders Asked to Deposit

NEW YORK, Feb. 10—Stockholders of Miller Rubber Co. have received a letter from the stockholders' committee urging them to deposit their certificates under the plan whereby the company will be taken over by the B. F. Goodrich Co. through an exchange of stock.

Calendar of Coming Events

SHOWS

Sheboygan, AutomobileFeb. 10-16
Peoria, AutomobileFeb. 12-16
Providence, AutomobileFeb. 14-22
Canton, AutomobileFeb. 15-22
Indianapolis, AutomobileFeb. 15-22
St. Louis, International Aircraft.....Feb. 15-23
Omaha, AutomobileFeb. 17-22
Helena, Mont., AutomobileFeb. 20-22
Copenhagen, AutomobileFeb. 21
Los Angeles, Automobile.....Feb. 22-March 2
Camden, N. J., Automobile.....Feb. 24-Mar. 1
Des Moines, AutomobileFeb. 24-Mar. 1
Seattle, Wash., Automobile.....Feb. 25-Mar. 2
Detroit (All-American Aircraft).....April 5-13
Asbury Park, N. J., Automobile.....April 7-12

CONVENTIONS

S. A. E. Aeronautic Meeting, St. Louis,
Feb. 18-20

Southern Automotive Jobbers Conven-
tion, AtlantaFeb. 20-22
Southwest Road Show and School,
WichitaFeb. 25-28
National Management Congress, Chi-
cagoMar. 3-7
American Society for Testing Materials,
Regional Meeting, DetroitMar. 19
American Society Mechanical Engineers,
Fiftieth Anniversary Celebration:
New YorkApril 6
Hoboken, N. J.April 7
Washington, D. C.April 8-9
National Council Meeting of the U. S.
Chamber of Commerce, Washing-
tonApril 28
U. S. Chamber of Commerce Annual
Meeting, Washington.....April 28-Mar. 1
National Foreign Trade Conference,
Los Angeles,May 21-23

World Power Conference, Berlin.....June 16-25
Railway Supply Mfrs. Assn., Meeting
and Exhibit, Atlantic City.....June 18-25
American Railway Association, San
FranciscoJune 23-26
American Society for Testing Mate-
rials, Annual Meeting, Atlantic
CityJune 23-27

SALONS

Palace Hotel, San Francisco,
Feb. 22-Mar. 1

RACES

IndianapolisMay 30
BelgiumJuly 5-6
Germany (Grand Prix).....July 13
Belgium (European Grand Prix).....July 20
SpainJuly 27
Italy (Grand Prix).....Sept. 7
France (Grand Prix).....Sept. 21